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THE RELATION OF COGNITION AND PHANTASY IN CHILDREN

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IV. COGNITION AND PHANTASY IN MALADJUSTED CHILDREN

(1) *Deficiencies in the cognitive functions*

WE have traced the development in the normal child of the stages of cognition and of its relation to phantasy, and brought evidence to show that it is necessary that these two modes of thinking should be closely integrated for the individual to understand intelligently and imaginatively. We obtain further evidence of this from the study of maladjusted children who have not achieved this integration, and in whom the development of either cognitive activity or phantasy seems to be abnormally retarded or inhibited.

The retardation of cognitive development is most familiar in the mental deficient, in whom cognition appears in a relatively undeveloped and undifferentiated condition. But there are other children whose cognitive ability appears to be temporarily reduced through somatic deficiencies or through emotional difficulties. Often these two conditions are coexistent.

As might be expected, the retarded child frequently responds in a manner similar to that used by younger children. Thus he may show a tendency to enumeration; for instance Alfred C. (age 9–7, I.Q. 76) in Exp. A gave responses of the type: "House and some trees and the path

and a house; sky and a few *birds.*"[1] But this is not the simple enumeration of the little child, but a form of compound enumeration which, as Binet pointed out, is rather characteristic of the child of low intelligence. It probably indicates that the child's power of observation of qualifying details has increased, without any corresponding increase in his ability to construct coherent verbal expressions. At a slightly higher level of intelligence the child may when interested be capable of descriptive responses, but will relapse into pure enumeration when it requires less effort to pick out details one after the other. Thus Fred C. (age 9–7, I.Q. 86) in Exp. B responded to the Tavern Brawl with:

> Two men went to stop one man; another man went to stop the other one; all the glasses knocked down on the floor; and man and a lady were frightened.

This is quite an adequate descriptive response. But for the Runaway Horse, which apparently he did not understand, he gave: "A horse; a milk-cart; a boy; a lady", etc. This is only a simple enumeration. It seemed that Fred's apparent low intelligence was in part due to poor health and physique and poor home environment. And it is probable that a child who suffers in this way, and not from a high degree of innate dullness, may at times fall back on a really childish form of response such as simple enumeration. Even a normally intelligent child with a physical handicap may tend to use a childish type of response. Thus Kenneth B. (age 7–1, Binet I.Q. 98, Performance I.Q. 126) was physically below par and suffered from deafness; he gave responses in Exp. A of the type: (C 3) "*Ship, house, sea, pathways*"; (B 4) "*trees, hill, grass, pathways*". But he could also manage a fairly good descriptive response such as: (F 3) "Two *people standing on a piece of grass*".

But the childish type of response was not always due either to innate dullness or to backwardness resulting from physical deficiencies. There was a considerable number of cases among the clinic children with normal or superior intelligence who employed either enumeration or the type of response we termed above 'designation'. In designation the child gives one or two names, sometimes briefly qualified, and then comes to a stop as if he had 'polished off' that piece of work and nothing more was required of him. These children were suffering from emotional difficulties of some kind or another which seemed to have the effect of inhibiting certain kinds of cognitive activity. One form of this inhibition was the return to the childish mode of expression. Thus Maureen P. (age 7–0, I.Q. 121) was a child who did brilliantly at school, but was given to screaming

[1] Words in italics denote inventions.

fits and uncontrollable temper tantrums.[1] In Exp. B she began with simple enumeration in responding to the Farmyard: "Three cows, three horses, three men", etc.; and to the Tavern Brawl: "Two stools tipped up, five funny men", etc. But she became more interested and less resistant by the time she reached the Runaway Horse, and gave: "A dog barking; a little girl fell over", etc., which is at least descriptive, though not very intelligently so. Kenneth M. (age 8, I.Q. 96), another aggressive child, gave responses in Exp. A which were more in the nature of designations: (C 4) "*Trees with houses on*"; (B 3) "*mountains and the sky*"; "all kinds of squares".

But this latter type of response was even more characteristic of the frightened, anxiety-ridden child, who was sometimes also physically subnormal. Thus Tom G. (age 12, I.Q. 95), who was depressed and fearful, and generally rather subnormal, gave in Exp. A: (A 4) "*A snake and a funny old man*"; (B 4) "a *map*"; (D 4) "*green grass*"; (F 2) "two *people pointing*". Leonard C. (age 7–9, I.Q. 83) was erratic, nervous, disobedient and in poor health; he gave in Exp. A: "Two *dragons*", "two *crabs*", "two *ships*", etc. These brief, apparently perfunctory, responses gave evidence of the inhibition of the normal powers of cognition; and a similar effect was demonstrated by another frequent phenomenon—perseveration. Thus Leonard gave "dragon" eight times, "ships" four times; the numeral "two" thirteen times, "three" three times, "four" twice. Another characteristic of such children was to produce inventions as if with the attitude: "Anything to save trouble, to satisfy the questioner, to make a better show, more of an answer." Thus with Leonard, "dragons" became a kind of routine invention when he could not think of anything else to say. Kenneth B. gave, "*trees, grass, pathways*", in the same way; and Alfred C., "And some *grass* and the *sky*". This type of response sometimes alternated with failure to respond. Thus Frank H. (age 10–2, I.Q. 145), nervous, anxious and fearful, observed perfunctorily, and several times said he had not seen the picture at its first exposure.

But perseveration and failure to respond are not always due to inhibition through anxiety; they may result from aggressive resistance. It is usually possible to tell from the child's general manner which state of mind is operative. Thus Kenneth M. (see above) made perseverative responses: "*mountains*" was given three times running. June C. (age 12–10, I.Q. 79) was not only of low intelligence but also obstinate and lacking in self-control; she gave several perseverative descriptive

[1] This and similar items of information are taken from the case histories.

responses, and three times gave no response. Again among the ordinary school children, designation, enumeration and perseveration of a perfunctory kind not infrequently resulted from resistance; the attitude being, "I can't see any use in this and I can't be bothered to try". Jean H. (age 7–2), who was of normal intelligence and not emotionally maladjusted, but merely naughty and inclined to 'show off', gave mainly designations including "*clouds*" (ten times). Jean O. (age 10–10), who was also resistant and inclined to think the whole thing silly, gave designations throughout such as, "*mountains*", "*clouds*", "*dragon*", etc.

The inhibition of cognition did not seem to affect the functioning of phantasy. It is true that in Exp. A phantasy was not extensive since verbal expression was poor and limited. Inventions were of a commonplace type and seldom involved conceptions of any originality. But they were frequent; and occurred sometimes with meaningful pictures as well as meaningless. Thus Alfred C. introduced into his responses to B 1 and C 1: "and a *few birds*". It is probable that there was considerable 'self-active' phantasy in these children, but it was more or less dissociated and unexpressed, as in the quite little children. In Exp. B, children of this type made free constructions at stage B, consisting as a rule of a number of separate and more or less unrelated groups; and the verbal responses were usually enumerative, or simply descriptive. The children who were rather subnormal mentally and physically showed a tendency to use the fairly peaceful and familiar type of situation. Thus Fred C. had put in people walking about a field, with various tame animals about. In the middle of these he had put a bear, and then asked what this animal was; when told it was a bear, he hastily removed it altogether. The more aggressive children constructed more unusual and dangerous situations; thus Maureen C. produced: "A sheep-dog driving some sheep, a man whipping a horse, a cat sitting on a polar bear, a giraffe eating a tree", etc. A rather interesting variety was produced by Percy C. (age 13–2, Binet I.Q. 67, Performance I.Q. 80), a child who relieved his feelings of inferiority and inadequacy by violent attacks on other children. He placed across the bottom of the field, in its lower quarter, a scene consisting of two men shooting wild animals which in their turn were attacking an elephant with a boy seated on it.

We may conclude then that the child's level of cognitive functioning may be below normal as the result of innate dullness (in which case the retardation is usually permanent), or of poor health and physique, or of some kind of emotional inhibition. There does not seem to be any lack

of phantasy in these children,[1] although its expression, in so far as this requires cognitive ability, is crude and limited. It seems that either aggressive resistance or neurotic anxiety may produce this inhibition of cognition.

(2) *Over-activity of phantasy*

The amount of invention was in general greater among the clinic children than among the school children (see Table IV, Part I, p. 285); and an over-elaboration of invention was found among the former. This indicated a tendency to excessive phantasy which occurred in few if any of the normal children, and was sometimes accompanied by severe neurosis.

There appeared to be two classes of children who showed evidence of excessive phantasy. In the first class were those who were relatively little dissociated; that is to say, their behaviour showed a fair contact with reality and their phantasy was not excessively 'magical' in content. But they suffered from violent fears and aggressions. Sometimes there seemed more signs of the former, sometimes of the latter, but there was always some alternation of both, and usually a good deal of chronic anxiety. The expression of phantasy seemed to afford a relief from this anxiety in that fear and aggression were given an outlet in it, but in a more or less symbolic form since they could not be overtly expressed. Among the more aggressive children George S. (age 12–3, I.Q. 82–87) was disobedient, nervous and excitable, with a difficult temper and vicious to other children. He gave rather long and detailed responses, often involving movement, with a good deal of imaginative invention, and colour naming. Colour naming (even more striking among the fearful children) was characteristically associated with excessive phantasy; colour seemed to produce a great impression on some of these children, similar perhaps to the 'colour shock' produced by the Rorschach Ink-blots.[2] It was often named inaccurately. George gave responses such as: (B 1) "A boy getting out down at the bottom of the see-saw; the little girl's *screaming* with her hands out; a wall, reddish colour, and a sky and clouds"; (A 4) "*a duck on its head under a rock* and something like *a fish peeping out*". One of the school children, Robert S. (age 7–3), produced rather unusually violent and aggressive inventions, e.g.: (A 3) "Looked like *a rock* with *boys throwing stones*"; (A 2) "few *rocks* and some *boys cutting each other*".

[1] It is possible that really mentally defective children are defective in phantasy also; but no data were obtained from such children.

[2] But in general the responses of these neurotic children seemed to cut across the adult 'Erlebnistypen' of Rorschach (*Psychodiagnostik*, 1932).

Among those children who suffered from anxiety and fears, the inventions often contained expressions of terrors of which they were not fully aware, or were unable to express directly. Thus in Exp. A., Hazel R. (age 8–11, I.Q. 116), a timid and tearful child with very numerous fears, produced long and very detailed descriptions of the following kind: (C 4) "Little black *path* with some *hedges* and a pink *sky* and there was a little *house* with a *red roof* and a bit of it was yellow and a bit was black, and some *green grass*"; (A 4) "some *hedges* with a black thing on top of a *hedge*—looked like a *cat*"; (B 4) "very funny—red—or orange—two bits —some *hedges*; did look funny". The words "hedges", "little" and "funny" were characteristic, and seemed to indicate the operation of a defence mechanism against her fears. Vera C. (age 8–9), who was suffering from repressed fears, gave responses which were equally detailed but more inventive. Each response contained an invention of some kind, and there was much movement and also suggestions of emotion in the persons and scenes described: (A 3) "Two *boys* next to each other, looks like they're *fighting each other*; the one on the left has got a green *hill* and the one on the right has got a *brown hill*; *they're out there all by themselves*; and a few *trees*, and the *sky* doesn't *look very bright*"; (B 1) "there were two boys on a see-saw, not holding it; look like *they're going to fall*; like little bushes on the floor; and *they're enjoying themselves*; with green and something else on it like *a hill*".

In one or two other children, phantasy seemed to be fairly extensive, but less so than in the above cases, and it was often expressed childishly and was eked out by gesticulation. Thus Joan B. (age 9–9, Binet I.Q. 107, Performance I.Q. 113), who was always day-dreaming and had fears of the dark, gave in Exp. A: (F 4) "*Ghosties*—funny things" (shrinking); (A 3) "green figures—looked as if *they was dancing—had their arms out*" (gesticulating). Sylvia H. (age 10–7, I.Q. 87+), backward, nervous and suffering from a sense of insecurity, gave: (E 3) "There's a round piece of *snake* and *the snake's going wiggle*, like *it's going to turn round*"; (A 3) "*a boy* all wiggly *with his hands out* and *a girl* all wiggly with *her hands* like this" (gesticulating). These children form a class intermediate between those in whom phantasy is over-active, and those in whom it is replaced by overt over-activity (see below).

In the second class mentioned on p. 5 were those children who seemed more dissociated, in the sense that their phantasy seemed to be abnormally self-active, uncontrolled and 'magical'. Thus responses even to meaningful pictures contained frequent inventions, and these showed how, once the phantasy had been 'touched off', it would go on of its own

momentum, without conscious direction from the child. This way of expressing phantasy is not common with normal children of this age, though it is more frequent with little children. Denis H. (age 7–6, I.Q. 99) was referred for being shy and nervous with strangers, and stammering; but in this experiment he responded volubly, with no signs of shyness: (C 1) "A house and a stream going by it and some grass and windows and doors—and *knockers* and *No. 2* and *3*—like that"; (A 1) "there's a boy and another chasing him and the other's on the grass and *he's turning the corner and he's nearer his house* and the grass is green and there are *clouds in the sky*"; (E 4) "three red *people* and blue *people* and you can't see their faces; and *grass underneath them*, and *they're dancing on grass*" (repeated from F 4); "and *green grass*" was added as an afterthought several times, when there was no green grass at all. Ronald H. (age 11–0, I.Q. 120), suffering from uncontrolled tempers, gave the following: (A 4) "Few *mountains*—(afterthought) and *two boys dancing*"; (E 2) "two or three *hills* in the background and two *trees* and *a man punting a small punt* like *a barrow* and *a stream*—(afterthought) and *a few flowers on the edge of the stream*".

Another example of this type was afforded by Ernest G. (age 10–0, Binet I.Q. 80, Performance I.Q. 119), who was a very over-active child, referred for lying and disobedience. This lying was in point of fact a tendency to talk at great length about things which had never happened; i.e. it was produced by over-activity of phantasy. Ernest in Exp. B described the Tavern Brawl and the Runaway Horse rapidly, at great length and with much excitement; the Runaway Horse was "going mad down the street". His free construction, also described at great length and somewhat incoherently, contained a great number of separate groups of men and animals, mainly involved in some kind of aggressive activity, thus: "A boy kicking the cow's bottom;...a man whipping a hippopotamus;...a tiger going after one of the lambs to eat him, and the brave hippopotamus going to eat *him*", etc., etc.

There were also two cases, one a clinic child and the other a school child, who produced not only an excessive amount of phantasy but also of detailed description. The description, however, was not very accurate, and thus it differed from that to be described in § (3). It seemed as if the child's powers of observation and report were greater than normal, but that he was unable to utilize them to great advantage because over-active phantasies constantly impinged upon them and distorted them. Thus instead of a coherent and synthesized imaginative interpretation, the result was a long and detailed but distorted and inaccurate descrip-

tion. Or sometimes description and invention occurred side by side in the same response without any attempt to relate the two, showing the dissociation of cognition and phantasy. Harold D. (age 13, I.Q. 100), unstable, fearful and hasty-tempered, gave: (A 2) "Some sort of *people* in the shape of zigzags *running towards each other*; the man on the *right* running had a red jersey and black trousers; the man is in a *green* jersey on the left and a *black* hat and *blue* trousers and had a black outline"; (C 4) "*a fruit tree with pears and apples hanging down*—crazy kind of way—*pears were yellow and apples red*—background a kind of yellowish *green*". Michael W. (age 7–5), an intelligent but nervous and excitable school child, gave: (B 2) "*An aeroplane* and *three little men*; green and all colours and a *path*; and *they've got a piece of rope and it was tied on to the tail of the aeroplane*—I think it was *an aeroplane* or *the shadow of the aeroplane*"; (C 2) "more like *a tank* and *it came down*; like *a camp*, and a piece like *a plank of wood*; like *a wall of a house* the other side and a brown *path* and a bit of *grass*".

It is of course true that Robert S., Denis H. and Michael W. were all of them only seven years old, so that they might have been expected to be inaccurate and incoherent in their responses. But the invention and incoherence, particularly of Denis and Michael, was quite different from that of other young children which we described in previous sections, and resembled much more nearly that of the older emotionally disordered children such as Harold D.

Rather similar to Harold and Michael was Hazel M. (age 10–3, I.Q. 148) in Exp. B. Her description of the Farmyard was unnecessarily detailed, with much colour naming. Her reconstruction of the Runaway Horse was rather inaccurate, but her verbal description was detailed, and included some emotional interpretation: "A lady's running screaming out of the house; another lady's leaning out of the window wondering what she can do." Her free construction contained a number of separate and incongruous groups of figures, described in great detail and rather incoherently, though there was an attempt to give them a rational explanation:

> A zoo—the animals are allowed to mix together; a gentleman and a lady walking, behind them a leopard; the elephant has forced his way out of his cage, and the man who looks after him is running after him; a man is cracking his whip at the bear who's come out of his cage and is chasing a boy; two men are going to shoot a horse who's wild and is charging a little girl; a man is trying to stop the man who's shooting the horse, etc.

Thus the child tended to give over-elaborate descriptions of presentations which gave little opportunity for imaginative interpretation. But when

such opportunity was afforded, she produced much phantasy which was extremely 'magical' in quality, and showed an almost obsessive reiteration of the theme of danger and counter-aggression.

(3) *Over-activity of the cognitive functions*

We must deal next with those children whose energy seemed to emerge in cognitive activity, sometimes in intelligent, accurate but hypercritical evaluations; and sometimes in excessively long and detailed verbal descriptions which were usually quite accurate but often unintelligent. It would appear that in these children phantasy was repressed and the expression of their desires and fears inhibited. Thus aggressive tendencies found an outlet in intellectual activity and critical evaluation of the outside world. And a means of escape from anxiety and feelings of inferiority was found in an over-elaboration of verbal response; this gave the child a feeling of power through his ability to deal with words, while at the same time concealing his inability to act, invent or, in some cases, think intelligently. We have already referred to the rather meticulous and over-conscientious children of this kind who were found among the ordinary school children (see Part I, p. 287).

An example of the first type was afforded in Exp. A by Cyril S. (age 10, I.Q. 122), a Jewish child who had reacted very aggressively to his father's authoritarian treatment. He gave very few inventions, and described the meaningless pictures as: (E 4) "Lot of paint—hasn't been used properly; there's the *sky*—that's the only good part about it"; (E 3) "paint's been used a bit better—*trees* are the wrong colour and the *pond's* red, should be blue"; and the meaningful ones as: (C 1) "Same sort of picture only done properly—house is in a different position—got windows and a door". One of his very few inventions was: (A 3) "Supposed to be two *people* there; looks like *they're going to have a fight*...". Here the child's aggressive and critical attitude had prevented him from observing properly (he was indeed much more interested in the working of the tachistoscope than in the pictures); but there was no doubt of his ability in intellectual activity. Jean Ba. (age 10–6, I.Q. 90), an equally aggressive but less intelligent child, gave somewhat the same type of response, but that her critical reactions were expressed by the word "funny"; (E 2) "*Trees* or something—looked very funny—all mixed up; and *grass*".

Another less extreme example was afforded by Lorna W. (age 9–0, I.Q. 122) in Exp. B. Here there was the same attitude of superiority, which appeared in the child's manner of speaking—in what is known

colloquially as an "old-fashioned way" (i.e. like that of a sophisticated adult)—and in her response to the Runaway Horse: "A lady that's looking at a milkman that's running after the cart that's drawn by the horse; he seems to have got a little wild for the moment;...a little girl's falling over and her mummy's looking at her as if she were saying, 'Oh dear!'." But there was appreciation as well as criticism; in her response to the Farmyard occurred: "A gate and a nice wall round it (the farmyard); a nice lawn." And the free construction was described in detail. It demonstrated the child's desire for free activity, together with her wish to obtain security by clinging to the family circle. Thus she first of all arranged a group of horses, saying, "A lot of horses; I love horses"; there was a group of horses being driven by a man with a dog, also one horse running away free. In another group a fox (called a "wolf") was going to attack some sheep, and a boy was running away from the "wolf"; but a dog had "just got the wolf". The "master is shooting some other thing" (a dog), and safely away in the further corner were "a mother and a daddy with two little girls". Thus it appeared that this child, although emotionally inhibited and unable to act freely, was less completely tied to purely cognitive activity, and was able to some extent to express her phantasied longing for free activity.

Another example of the intelligent, rather aggressive and over-excitable child whose energy found an outlet in verbal activities was given by David D. (age 10–9, Binet I.Q. 120, Performance I.Q. 145). His descriptions were not made in a critical spirit, but showed great verbal elaboration and some suppressed excitement; thus for the Tavern Brawl: "Lady's got a look of terror and dismay on her face, and so's the barman." But his free construction was soon finished; it consisted of a man and two dogs attacking a fox, while a man, a woman and two children, widely separated from each other, stood round watching. Thus the danger was being driven away and segregated from the rest, the cognitive part, of the personality, and at the same time phantasy was more or less repressed.

We turn now to those cases who compensated in verbal activity for their anxieties and feelings of inferiority. Oliver G. (age 11–7, I.Q. 137) was nevertheless slow and backward in school, lacking in initiative, apologetic and afraid of ridicule and failure. In general his responses in Exp. A were objective and accurate: (C 1) "There's a small house with a red roof and yellowy walls and there's smoke coming out of the chimney and a long path going to it". There were few inventions; meaningless designs were described objectively: (D 3) "There's a green triangle and

a few other coloured shapes in it"; or dismissed as impossible to describe: "Just a muddle of painting"; "worse painting". These remarks were made, not with the superior attitude of Cyril S., but with docility, as if polite but puzzled at what he was supposed to say.

But compulsive speech seemed to have reached a maximum in one rather unintelligent school child in Exp. B—Jean B. (age 11). Her responses to the various pictures are too long to quote—that for the Farmyard alone contained 163 words, with numerous repetitions and much colour naming; and it would not have ended there, had she not been stopped. But this compulsion seemed to extend to her free construction. This contained forty-two figures, arranged singly, in pairs or in small groups, and described as follows:

> Most of the people are trying to run away from the tiger and the bear; one of the horses is going nearly mad;...one of the boys is running towards the tiger and one running away;...a soldier trying to kill it, and another man behind a tree to help; a wild boar running away,...a dog going after him, another fox and two boys going after him, etc.

Thus this construction in fact resembled the incoherent constructions of stage A (see Part I, p. 288). But the child was able to give it a long, rambling, unintelligent description. It appears that phantasies of danger and aggression were not altogether repressed, but were functioning at a very childish level. At the same time she was trying to compensate for her feelings of inferiority by this method of verbal over-elaboration.

(4) *Inadequacy and repression of phantasy*

We come lastly to those children who seemed to have little ability to express phantasy, without any corresponding over-compensation in cognitive activity. These seemed to fall into two main groups: firstly those who seemed generally repressed and inhibited, lacking in any spontaneous energy; and secondly those who were apparently too dissociated for any expression of their energy in phantasy or cognition—this energy flowing over into over-activity and general restlessness.

Among the former was Ronald F. (age 12–6, I.Q. 95) who was quiet, docile, anxious, lacking in energy and initiative. His replies in Exp. A were brief; there were some inventions, but they were mainly rather commonplace, and there was some perseveration. The manner of reply was characteristic; it was stereotyped, as if the child were rigidly confined within himself and unable to emerge—see for instance the consecutive responses to F 1–4 and E 4: "Some men shooting bows and arrows"; "some *men* without bows and arrows—and *fields*"; "some *men* all in red,

walking in the country"; "some paint all mixed up"; "some *scenery*". John N. (age 7–5, I.Q. 112), shy, nervous and full of fears, often seemed too constricted to observe and answer; seven times he was unable to give any response at all, and when he did respond, it was very briefly done: "Rough sea"; "some boats"; "little men", etc.

There were no very obvious examples of this type among the clinic children in Exp. B, but a very clear example occurred among the school children. June N. (age 11, intelligence above normal) appeared to be completely inhibited in observation and verbal description, in memory reconstruction and in free construction. She was very slow in answering and her responses were mainly simple enumerations. She had the greatest difficulty in completing her reconstruction of the Runaway Horse. In free construction, she slowly turned the figures over and over; gradually selected a few and arranged and rearranged them; and when she had finished, left the remainder of the unwanted figures lying muddled up with her construction, as if too inert to move them. The construction, which after great hesitation she called "Field", consisted of two isolated groups, one of a man, a horse and a cow; the other of a man and two horses, with a child separated from the man by a tree. Thus not only was all the more imaginative type of phantasy suppressed, but even her contact with the things of everyday life was slight.

The second class of children mentioned above included some cases of rather severe neurosis accompanied by dissociation. Derek S. (age 9, I.Q. 112+) was suffering from a severe disorder connected with an undescended testicle, which made him violent, restless and inattentive. His observation in Exp. A was careless and his responses perfunctory, since he was unable to keep his attention fixed even for that length of time. There were one or two inventions, of "worms", "reptiles", "shadows", etc.; and numerous responses of the type: "Big painting—nothing in particular"; "all wiggly-woggly men in the picture"; "all sort of isolated". John W. (age 8, I.Q. 111) was aggressive, nervous and difficult. During the experiment he was very restless and obstreperous, and expressed a desire to break the tachistoscope; he was quite interested in the pictures, but too inattentive to observe and report much. He produced rather more inventions than did Derek, but was liable to save himself trouble by perseverating, thus: (F 2) "*Two men putting their arms out*"; (F 3) "two red *men putting their arms out*"; and again: (B 3) "Some funny *clouds*"; (B 4) "some *clouds* again"; (A 4) "some very black *clouds*".

An interesting example of partial dissociation with repression of phantasy was afforded in Exp. B by Alan R. (age 11–10, Binet I.Q. 95,

Performance I.Q. 79). He was nervous, restless and over-active in behaviour and unable to concentrate. His verbal responses were very rapid and incoherent; for instance, to the Runaway Horse:

> Dog's escaped and they're afraid the babies will get killed; woman rushing out of the house after them; looks as if the dog started him off going mad; and he's running after him; perhaps he's running after the dog.

The idea of escape from captivity also appeared in his response to the Farmyard: "Big wall, and they can't escape out." His constructive work was done jerkily, with great eagerness; figures were pulled out and hastily thrown aside. It was described as follows:

> Lady's walking and baby's running after her[1]; (pointing) he's taking the elephant to have a drink down there; (pointing) these two have been to do some shopping; (pointing to the wild boar) that one's asleep; (pointing to the remaining animals) eating the grass and just walking about.

Again almost the only coherent idea that emerged was of the child who had been left behind by her mother because she was naughty, and was now running after her, away from the animals. Alan presented a good example of a child in whom neither cognition nor phantasy expression were developing satisfactorily. Cognition was incoherent and distorted, and phantasy was not even fully 'self-active' but was centred about one or two *idées fixes*. In consequence, neither provided a satisfactory outlet for his energy, which tumbled over into free activity and general restlessness.

(5) *Abnormal divergences in cognition and phantasy*

It is now necessary to summarize the information obtained about the nature of the divergences in cognition and phantasy which can occur as the result of emotional maladjustment. We have seen that there may be a persistence of the childish form of response to perception, namely enumeration. But it appears that even in intellectually subnormal children the response does not consistently regress to its earlier childish form; it more commonly takes on a new form which is a modification or distortion of this. It seems that the child is unable in certain circumstances to respond in the manner which is normal for a child of his age, and he attempts to regress to an earlier form of response. But the experience and the emotional development of the older child are such that this is impossible. Therefore he does not consistently produce simple enumerations. This may occur occasionally, especially in children of poor physique or innate dullness; but compound enumeration and designation

[1] He indicated that the child had done something naughty for which she was being punished, but too incoherently to be recorded.

are more frequent. The former seems to be more characteristic of the compulsive type of child, the latter of the anxious and inhibited or openly aggressive types. Furthermore, if the child's interest is sufficiently aroused to overcome his inhibitions or resistances, he may produce descriptions of the kind normal for a child of his age. It is not that normal cognition is undeveloped in such children, but that it does not always function effectively. Other symptoms of this dysfunction are failure to respond, perseveration of response, and inventions of the kind described on p. 3 of the "anything to make more of an answer and satisfy the questioner" type.

We saw that in these cases of attempted regression to a childish type of cognition, phantasy expression appeared to be relatively normal. There seemed, however, to be a dissociation between cognitive activity and phantasy expression, a temporary blockage which was sometimes removed in states of interest or excitement. But as long as the blockage remained, comparatively little of the child's energy could flow into his cognitive activities, and the latter appeared in a distorted form of the brief and undeveloped cognition of the little child. Thus cognition was unable to develop normally. In particular, the child could not attain to the active manipulation of phantasy material, and hence the highest form of integration between phantasy and cognition constituted by interpretation and stage C of imaginative construction. It is interesting to note that none of the clinic children produced a free construction which was really a unified whole (though Stanley H. came near it).

In some cases energy seemed mainly to flow into phantasy production. The child's emotional problems seemed so acute that 'self-active' phantasy, the means *par excellence* of expressing these problems, absorbed a large part of his energy. His cognitive abilities were not so much undeveloped as unused, pushed on one side by over-active phantasy. When they were used, they were often superior in quality (some of these children had high I.Q.'s). It was not that the child was unable to perceive, remember, think, respond verbally; but that his perceptions and memories were inaccurate, his thinking proceeding from false and unreal premises, associatively rather logically directed, his speech fluent but incoherent. Thus his verbal responses were apt to resemble a description of a dream (see particularly Hazel M.'s description of her free construction on p. 8), and showed that the child had little contact with objective reality. Instead of manipulating his phantasy material by means of cognition, he was subordinating his cognitive abilities to the dictates of 'self-active' phantasy.

But there were other cases in which for some reason or other the child was unable to express his phantasies. In extreme cases the child seemed to be suffering from a state of all-round inhibition, so that his general behaviour was unusually timid or constricted. His verbal responses in the experimental situation were brief and stereotyped, enumerative or designatory, and perseverative; and he was sometimes unable to respond at all. He produced few inventions; and his constructions were unoriginal and carried out with difficulty. But in other cases there seemed to be an overflow of energy into overt activity, either voluntary—in running about, playing games, etc.—or involuntary, in restlessness, overmovement, inattentiveness, etc. In the latter case, the main characteristics in the experimental situation were perfunctoriness or incoherence of response. The child was too restless and inattentive to observe or remember accurately, and any sort of answer that required little effort was produced. Inventions were few and banal; there was much repetition, sometimes of rather childish expressions such as "all wiggly-woggly". In the incoherent cases, speech seemed to be one of the forms of overt activity suffering from over-movement and lack of control. But in the case of Alan R., quoted on p. 13, expression of phantasy was not completely lacking. It was narrowed down and centred about a single situation—the inability to escape from danger.

Lastly there were those cases in which energy seemed to be confined to cognitive activity; in some cases to intellectual activity, in others to perceptual and verbal activity. But the latter were quite unlike those of Alan R., spontaneous and voluble. They were slow, laboured, careful, exhaustive and even repetitive. In other words, the child was not using his energy in free verbal activity; but seemed to be using it in overcompensation, to force his cognitive functions up to a higher intellectual level, one which he was unable to reach naturally, if at all. Thus a younger or less intelligent child such as Jean B. (p. 11), might aim at meticulous accuracy and exhaustive detail in observation and description. An older and more intelligent child, if of a rather timorous disposition, might show the strain in his apologetic attitude in responding to the meaningless designs; he was unable to perceive and describe them accurately, but would not dismiss them as incomprehensible. If he was of a more aggressive type, he projected this inability to perceive and understand back on to the 'silliness' or bad draughtsmanship of the presentations. In any case, lack of power to express phantasy was shown by the fewness of inventions in Exp. A. In Exp. B the free constructions were either themselves perfunctory and restricted, as with David D.; or showed that

the child was restricted and unable to indulge in free activity, as with Lorna W.; or remained undeveloped, childish and incoherent, as with Jean B.

This brings us back to the divergences in the form and content of phantasies which occurred in certain of the maladjusted children. As demonstrated in the inventions of Exp. A, it might be abnormally slight in quantity and banal in content, i.e. too greatly dominated by cognition; or it might be abnormally frequent and luxuriant, and unlinked to reality. Thirdly, it might contain references to emotional states and activities, or emotion-provoking objects, which were more exaggerated and more 'unreal' than is normal in children of this age. As demonstrated in the free constructions of Exp. B, there were similar possible variations. Thus the constructions might contain few figures, selected and arranged with difficulty, representing familiar scenes containing little or nothing that was inventive. They might contain very large numbers of figures arranged with the wild incoherence of the little child, or in segregated or unrelated groups. Since the possible variations were numerous, the type of content threw much light on the emotional problems which the child was representing in symbolic form: the wild animals attacking or being attacked; the segregation of groups of people or animals from each other; and particularly the position of children, protected by adults or segregated from them or surrounded by wild animals, etc. In contradistinction to this, the normal stage of adult development in making such constructions is to produce a single unified whole, what we should term 'a picture', in which the various figures are related to, and their arrangement determined by, some single, verbalized concept. No child was able to reach this stage unless his cognitive abilities had matured sufficiently for him to use them actively in selecting elements from the contents of his phantasies, and in synthesizing these, before they were expressed with cognized material in an integrated whole which was consistent with his knowledge of objective situations in the real world. Clearly this must have involved a parallel process of subordination and control of phantasy, so that the latter was no longer 'self-active' as in the little child, and in the maladjusted older children described above.

Finally we may advance the hypothesis that the essential difference between the childish phantasy and the adult imaginative process consists in a shift of the unifying principle. In the childish phantasy this latter is the gratification of the instinctual self; and so it remains in the adolescent day-dream. But the adult imaginative process or interpretation is centred about some objectively cognized situation existing outside the self; and

the self and its wishes operate indirectly or secondarily, if at all, in determining the course of the process. Now it is only in the very young child that *perception* seems to be a function mainly of processes within the self. From quite an early age the percept is at least referred to the external world; that is to say, the individual believes that it results from situations external to himself, and that therefore it obeys the principles of external causality. Moreover, as the child grows older he obtains an increasingly accurate knowledge of these principles; and by the time he has reached the age of nine or ten he is thoroughly familiar at least with the commoner ones. Thus in children of this age, such as we have described in this paper, there is a hiatus between perception, with its external reference, and the self-centred and self-determined phantasy.[1] And it is only when the individual has gained the ability to project the centre point or unifying principle of his phantasy away from himself, to give it an external reference and modify it in accordance with his knowledge of external reality, that phantasy and cognition can be fully coordinated about the same unifying principle in imaginative interpretation. Thus we might hazard a guess that the maladjusted child is retarded in this form of development because he is unable to detach his phantasy from his own ego. Since he cannot project it outwards into the external world, it cannot be directed and developed in accordance with his knowledge of external reality. The gap between cognition and phantasy remains, phantasy retains its 'magic' quality and true imaginative interpretation cannot develop.

The observations described in this paper present several aspects of this incoordination of cognition and phantasy. They are less instructive with regard to the fully coordinated imaginative interpretation, which by the very nature of its complexity and subtlety is difficult to investigate. Consequently the hypothesis advanced of the detachment of phantasy from the self and its outward projection is unproven, and requires further work for its demonstration.

V. SUMMARY

1. When a child is shown fairly complex pictorial material and asked to "tell me about it", he will, when quite little, respond enumeratively, that is, with a string of names of objects represented in the pictures. By the age of about seven, the normal child is able to give simple descriptions

[1] In the 'inventions' produced in Exp. A, hesitation, resulting from the ambiguity of the external presentation, occurs between objective perception and subjective phantasy.

of pictures, which gradually become fuller as his age increases. Irrelevant detail is suppressed, and the actions and emotions of the people depicted are inferred and described, in what we have called partial interpretation. But it is not till the child is eleven or older that he is able fully to understand the picture and interpret it as a whole.

2. When the child is given fuller opportunity of expressing phantasy (in spontaneous invention in response to semi-diagrammatic meaningless designs, or in free construction of a picture with cardboard figures), a similar process of development is observed. With quite little children, at what has been called stage A, invention and construction are incoherent and apparently without meaning. Either the child's phantasies are too incoherent for him to be fully aware of them; or there is too great a segregation between phantasy and cognition for the employment of cognitive techniques in the expression of phantasy. With children of seven and upwards, at stage B, phantasy inventions appear in the child's responses to meaningless material, differentiated more or less clearly from what he perceives in the objective situation. In free construction, segregated groups of figures show in various forms the lack of integration between phantasy and cognition. Finally, at stage C, by the active use of cognitive abilities, cognitive and phantasy material are synthesized into a single, unified imaginative interpretation or construction; this does not occur until eleven years of age or more.

3. In children whose natural development has been retarded or distorted by lack of intellectual development, poor health or physique, or emotional disorder, the above stages are modified in various ways; and the child may be unable to reach the final stage of imaginative synthesis.

(*a*) The cognitive functions may be impaired. The child, unable to cognize in the manner normal at his age, attempts to regress to a more childish mode of expression. He does not as a rule show consistent simple enumeration, but more often compound enumeration (the names being qualified to some extent) or 'designation' (a brief naming of what he takes to be the subject of the picture); these are accompanied by perseveration, stupid invention and failure to respond. Phantasy seems fairly normal, though the expression of it is rather banal.

(*b*) Phantasy may be over-active, so that the child's mind seems to be dominated by it, and his contact with reality impaired. Inventions are very numerous, containing much description of emotion, movement and colour; they are 'magical' in character, and occur in the responses to meaningful material. Free construction is also over-elaborate and dream-like, showing exaggerated 'self-active' phantasy.

(*c*) The child may be lacking in ability to express phantasy. In some cases his energies seem to be entirely dammed up, so that he is inert, constricted, unable to respond except in a very brief and stereotyped manner. In other cases his energy seems to flow over into overt activity: into spontaneous physical activity, great volubility, or general restlessness and over-movement. Here the experimental response is perfunctory and poor in quality, although in voluble cases it may be considerable in amount, and very incoherent. Finally, the energy may be forced and canalized into certain forms of cognitive activity, particularly intellectual or verbal. In the former, responses are intelligent, accurate, objective and sometimes severely critical. There is little invention, and free construction is limited. In the latter, they are exhaustively detailed and meticulously accurate, but usually quite unintelligent; and free construction may show phantasy to be in as incoherent a state as that of a little child.

I wish to make acknowledgement to the Medical Research Council for the personal grant which made this work possible. My thanks are due to the Directors of the Tavistock Clinic and the Institute of Child Psychology, and to the Head master and Head mistress of the schools, for the facilities afforded by them for carrying out this investigation; and to all those in clinics, schools and elsewhere who helped me in diverse ways.

APPENDIX

The Tachistoscope

For Exp. A it was necessary to use a tachistoscope which was portable, and which could present pictures of a reasonable size clearly and instantaneously, and also easily, without necessitating rigid fixation and monocular vision (since it was to be used with children). Moreover, it was desirable to avoid any distracting noises and changes in brightness of the field.

The apparatus is seen in longitudinal vertical section in Fig. 3 and in cross vertical section (at right angles to the line of sight) in Fig. 4. The pre-exposure field E_1 was a white rectangle, 5×4 in., with a black cross in the centre of it. It was illuminated by light passing through the aperture A_1 from the lamp L_1. Light from E_1 was reflected from the tilted plate glass M (see dotted line in Fig. 3) through the aperture A_4 to the subject's eye. The pictures, etc., to be presented were slid into the slot at E_2, the exposure field. This was illuminated by light passing through the aperture A_2 from the lamp L_2. Light from E_2 passed by direct transmission through the plate glass to the subject's eye. The brightnesses and optical distances from the eye of E_1 and E_2 were equal, and their optical images coincident.

E_1 and E_2 were illuminated alternately in the following manner: The arm R_1 of the shutter $S_1S_2S_3$ was pivoted upon and could move about an axis at P_1. Another arm

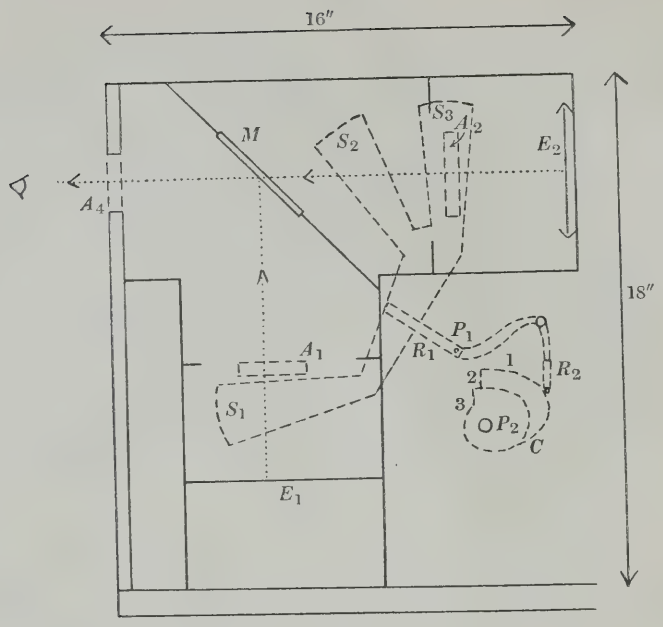
16″
18″
M
S_2
S_3
A_2
E_2
A_4
A_1
R_1
P_1
1
2
3
R_2
P_2
C
S_1
E_1

Fig. 3.

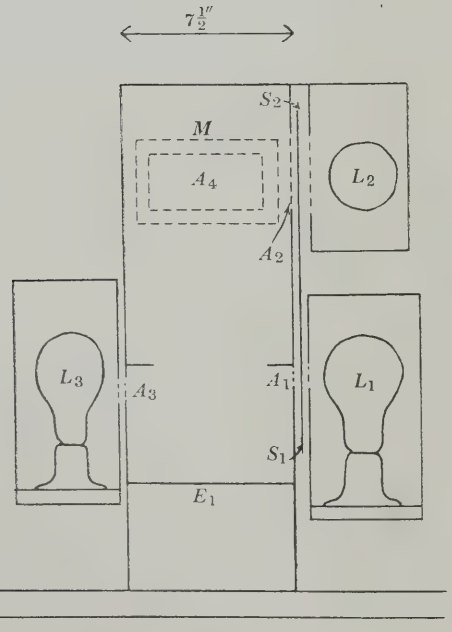
$7\frac{1}{2}$″
S_2
M
A_4
L_2
A_2
L_3
A_3
A_1
L_1
S_1
E_1

Fig. 4.

R_2, rigidly connected to R_1, moved upon the cam C which rotated at uniform speed about P_2. During pre-exposure, R_2 was at position 1, A_1 was uncovered, but A_2 was covered by S_3; during exposure, R_2 was at position 2, A_1 was covered by S_1, and A_2 was uncovered; and after exposure, R_2 was at position 3, A_1 was uncovered and A_2 covered by S_2.

Between each exposure, while the cam and shutter regained their zero positions, and R_2 regained position 1, the main circuit was switched off, and a subsidiary circuit switched on to the lamp L_3; this illuminated the pre-exposure field through the aperture A_3. When the cam was once more in position 1, the secondary circuit was switched off and the main circuit switched on. This alternation was carried out instantaneously by means of a rocking mercury switch.

The cam was driven by an electric motor. The length of exposure could be varied from 1·0 to 3·5 sec., by (1) altering the relative positions of the two parts of the cam by swivelling them about each other, (2) varying the speed of the motor.

A chin rest was provided so that the subject could place his head in a convenient position for looking straight through A_4. But it was not really necessary, and in fact the children often did not use it.

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THE CONCEPT OF THE 'SCHEMA'

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Part II.

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(i) *General purpose of the study* (pp. 22–23).
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VI. Third experiment, on the differences in remembering which occur when children learn by participation or by instruction

(i) *General purpose of the study*

In the first two experiments certain circumstances under which schematic differences arose were investigated. It was found that, "what the child makes from given material" varies with the difficulty the material has for him, and with his own characteristics, such as age and social experience. This experiment investigates the differences occurring in remembering when the learning methods themselves are devised to allow the child more or less freedom in "making the material his own". In one case learning, following the pattern commonly called the 'project' or 'enterprise' method, allows the child to deal with the material in his own way, and according to his own interests and understanding. In the other case learning, following the pattern of the 'drill' or 'instruction' method, is directed by the teacher. The teacher, in this case, attempts to convey to the child the items he wants him to remember, and the form in which they should be retained. This experiment investigates what differences in remembering actually result from these two methods of learning. We are

interested in discovering what schematic differences, if any, result from them, and how these are related to the amount remembered of the actual given material.

(ii) *Relation to education*

While this study is concerned primarily with the schematic differences arising in these two cases, the experiment has a very real significance for educational theory and practice. Typical of the new philosophy of education are these statements which appear in the new programme of studies for primary schools in Ontario:

> Information which is interesting and useful is retained in virtue of its interest and use, not in virtue of its having been crammed for an examination.... What is necessary, if we wish children to retain "facts" is not to require that they be memorized but to clothe them with interest and provide opportunities for their use ((10), p. 10.).
>
> The purpose of the...activities is not the amassing of knowledge in neat lists and summaries but the development of interests and the forming of attitudes. It is to be expected, however, that *each child out of his own interested activities will learn more facts and better facts to add to his personal fund of information than he would be memorizing ready made second-hand information* (My italicizing) ((10), p. 59.).

In reading these statements, the close relationship between the philosophy underlying them—that interested activity is the basis of learning—and Bartlett's theory of remembering, is apparent. It is also apparent that these statements are based on psychological assumptions rather than upon experimental evidence. The claim made in these quotations—that the child "will learn more and better facts" when "they are clothed with interest and given opportunity for use" than when they are simply memorized—forms an important part of the problem we are investigating in this experiment.

From the above discussion the purpose of this investigation may be summarized in this way. Given these two methods of learning (which may be described as 'interested activity' and 'memorization', or as participation and instruction, or as the project and drill method) we attempt to discover:

(1) By which method "more and better facts" are remembered;

(2) What differences result in the way in which the child is able to use these 'facts'; that is, what does he do with what he has learned?

(iii) *General method*

In conducting this experiment it was attempted, in accordance with Bartlett's method, to avoid artificiality as much as possible. While Bartlett attempted to obtain reality by using material as much as

possible "like that with which the subjects would actually deal", in this experiment the reality was extended to make the setting and procedure as close as possible to those commonly found in the school. The school principal, with whom the nature and purpose of the work were discussed, described the experiment to the teachers as an attempt to evaluate different methods of learning and explained the outline of procedure to them. This was followed by detailed typed instructions for each part of the experiment. The whole investigation was conducted in the school as a study based on the children's own interests rather than one having outside scientific implications.

(iv) *Outline of the experiment*

The pupils in three classrooms, A, B and C at Grade 5 were subjects. These groups, according to school standards, were considered approximately equal in their educational achievements. Their scores on verbatim recall tests after a preliminary reading were secured; and the 'project' method was adopted by the weakest group.

(*a*) *Material.* Two contrasting selections were used. One was a gay, lively poem which educationalists believed to be full of interest for the children.

Don Durk of Dowdee

Ho for the pirate Don Durk of Dowdee!
He was as wicked as wicked could be,
But oh, he was perfectly gorgeous to see!
The pirate Don Durk of Dowdee.

His conscience, of course, was as black as a bat
But he had a floppety plume on his hat
And when he went walking—it jiggled—like that
The plume of the pirate Dowdee.

His coat it was crimson and cut with a slash,
And often as ever he twirled his moustache
Deep down in the ocean the mermaids went splash
Because of Don Durk of Dowdee.

He kept in a cavern, this buccaneer bold,
A curious chest that was covered with mould,
And all of his pockets were jingly with gold!
Oh, klink! went the gold of Dowdee.

It's true he was wicked as wicked could be
His sins they outnumbered a hundred and three,
But oh, he was perfectly gorgeous to see!
The pirate Don Durk of Dowdee.

The second was a prose selection *King John*, which was considered badly constructed, confusing and dull.

The Magna Charta

John, the brother of Richard I, now became king. He was a bad king in every way. He was cruel and greedy, untruthful, boastful, and cowardly. In the beginning of his reign, he was guilty of the murder of his nephew Arthur, who was the son of his elder brother, and therefore the rightful heir to the throne. This led to a war with France, and by the year 1204 John had lost Normandy and most of the other provinces which had belonged to his father.

John continued to oppress his subjects in various ways in order to obtain money, and treated those who opposed his wishes with great cruelty. The people bore with John's bad ways for a long time; but at last they resolved to put a check upon his actions by making him sign a Great Charter, in which were drawn up a set of laws which would bind him to rule justly for the future.

The great barons, headed by Stephen Langton, Archbishop of Canterbury, took the lead, and all the people joyfully supported them.

The meeting took place in a meadow at Runnymede, on the Thames. It was a bright June day in the year 1215 when John, accompanied by a few of the nobles, rode down to the place from the neighbouring castle of Windsor. When the famous roll of parchment was spread out before him and read over, he did not waste any time, but carelessly took up the pen and signed it, and then set his seal to it. His heart, however, was full of rage; and as soon as he got back to the castle, he threw himself on the floor, and gave vent to his anger in terrible oaths and threats.

The most important provisions of this Great Charter were the following: (1) no one was to be wrongfully imprisoned; (2) no money was to be taken illegally from any one for the King's use; (3) justice was to be properly administered. But the great men who had drawn up the Charter knew that the faithless King who had signed it could not be trusted to keep his word; so they appointed twenty-five of their number to see that the wise laws which they had written down were properly kept.

His wicked life, however, was shortly afterwards brought to a close. In crossing the sands of the Wash with his army, the tide came in so suddenly that all the baggage wagons, with the stores and money, and even the crown jewels, were swept away. He took this loss so much to heart that he was seized with an illness; and a few days afterwards the people of England heard without regret that the tyrant was dead.

(*b*) *Procedure.* Different methods of learning were adopted by these groups:

Group A. This group learned by repeating the material, and being instructed in it by the teacher. The children were not encouraged to ask questions or discuss it. This will be referred to as the 'drill group'.

Group B. This group learned the material by repetition combined with class discussion and verbal participation. The teacher tried to connect it with interests and facts already established.

Group C. This group learned the material by dealing with it in the various ways they suggested—drawing pictures of it, making a play of it, etc. In their supple-

mentary reading periods they were allowed to find reference material which would help them. There was very little 'drill' used. This will be referred to as the 'project group'.

The experimental procedure was as follows:

These groups were classroom groups composed of about 40 children. The learning periods were equated in half-hour periods.

Don Durk

1. Thursday. Teachers read the poem through twice. Immediate reproductions were obtained.
2. Friday. The groups learned the material by the three assigned methods.
3. Monday. Pupils were asked to "write a story, pretending you are Don Durk and that you are sitting at home telling your friends of yourself and your adventures".
4. Tuesday. Pupils were asked to "write down all you can remember of the poem about Don Durk. Use the actual words of the poem as much as possible."
5. Wednesday. The poem was read through twice; the children followed it on mimeographed copies. A verbatim recall of the poem was obtained.
6. Thursday. An objective recall test was given.
7. Three and a half weeks later the objective test was repeated.

King John

(Given a week after *Don Durk* had been learned)

1. Thursday. The selection was read through twice; the pupils followed it on mimeographed copies.
2. Friday. The groups learned the material by the three assigned methods.
3. Monday. Pupils were asked to "write a story pretending you are one of the barons who is telling his children of the things he and his friends did during King John's reign".
4. Tuesday. The selection was read through twice by the teacher and group and a verbatim recall test was given.
5. Wednesday. An objective recall test was given.
6. Three and a half weeks later the objective test was repeated.

(v) *Analysis of results*

Two methods were used in analysing the results: (1) The results were analysed to show the amount of the actual material the children had mastered. This was done by verbatim recalls and objective tests. (2) A study was made of what the children did with the material when given a free setting to use it. This was obtained by asking for stories based on the general thought of the given selection.

(1) *Quantitative differences.* These were measured in terms of the scores obtained on verbatim recall and objective tests.

With *Don Durk*, verbatim recall scores were obtained from all groups after the preliminary reading, three days after the learning period, and immediately after a short, supplementary drill period. In scoring these recall tests, the poem was divided into seventy-three 'idea-units'. A chart listing each of these idea-units was made and each time one of them occurred in the children's recall it was scored. By this means a graph was obtained which showed, not only the total amount recalled by the group, but the relative degree each idea-unit was remembered. Differences in the amount each part was remembered can readily be read from group to group.

Objective recall tests were obtained a day after the supplementary drill period and repeated three and a half weeks later. In part 1 the subjects had to check on a list of twenty-four nouns the ones which came from the poem, and in part 2 specific questions about the poem had to be answered.

In the verbatim tests the amount recalled by the group is given as a percentage of the total amount the group could score if each member of it gave every idea of the poem. The objective tests are given in terms of the average of the individual scores. Table I shows these results.

Table I. *Scores on verbatim and objective tests obtained by three groups learning a poem by different methods*

	Group A	Group B	Group C	Average
Verbatim tests (group scores as percentages of total possible score)				
1. Preliminary test	29·7	33·3	23·6	28·9
2. After learning	57·5	50·7	30·6	
Increase from 1	27·8	17·4	7·0	
3. After extra drill	84·8	77·9	70·9	77·9
Increase from 2	27·3	27·2	40·3	
Increase from 1	55·1	44·6	47·3	
				Possible score
Objective tests (averages of individual scores)				
1. Immediate test				
Part 1. Wrong	0·6	0·5	0·4	12
Right	10·9	11·3	10·8	12
Part 2. Questions	10·3	9·5	9·5	12
Total	20·6	20·3	19·9	24
2. Remote test				
Part 1. Wrong	—	0·9	0·5	12
Right	—	10·6	10·7	12
Part 2. Questions	—	9·9	9·8	12
Total	—	19·6	20·0	24
Difference: Remote – immediate	—	– 0·7	0·1	

From this table it will be seen that on the preliminary test, group C, scoring 23 %, compared with 29 % in group A and 33 % in group B, is the

weakest; it therefore was used as the 'project' group. The scores obtained after the three methods of learning had been used show that group A—the drill group—with an increase of 27 %, makes the best progress, and group C, with an increase of 7 %, the poorest; group B's achievement is midway, the increase being 17 %. With the short additional drill period group C (gaining 40 % to 27 % of A and B) makes a greater increase in achievement than the other groups. The scores after the supplementary drill give A a 55 %, B a 44 % and C a 47 % increase from the starting point set by their scores on the preliminary tests.

It should be noted that although the increase in verbatim recall is least in the project group after the learning period, the short supplementary drill brings the achievement of group C to a standard comparable with the other two groups.

On the first objective test the average scores out of a possible 24 are, A 20·6, B 20·3 and C 19·9. On the test given three and a half weeks later the average scores are B 19·6 and C 20·0. Therefore, it may be said, that the three groups score almost identically on this test.

With *King John*, verbatim recalls were obtained after the preliminary readings and after the learning period with a short drill added. The objective test was composed entirely of specific questions. This was given one day after the drill period and repeated in three and a half weeks. Table II shows the results.

Table II. *Scores on verbatim and objective tests obtained by three groups learning a prose selection by different methods*

	Group A	Group B	Group C	Average
Verbatim tests (groups' achievement scored as percentage of total possible score)				
1. Preliminary test	24·8	23·7	18·2	22·2
2. After learning period and drill	38·4	38·6	34·9	37·3
Increase	*13·6*	*14·9*	*16·7*	
				Possible score
Objective tests (averages of individuals' scores)				
1. Immediate	16·9	18·3	17·4	31
2. Remote	14·4	16·0	15·3	
Difference: Remote – immediate	−2·5	−2·3	−2·1	

Group C, scoring 18 % of the 104 units, compared with 24 % in group A and 23 % in group B, was again the weakest in the preliminary test. But the increase achieved on the second test by group C was 16 %, compared with 14 % in group B and 13 % in group A. The difference in recall of content among the groups is very slight. The objective tests also

show no significant difference among the groups, the average scores being, A 16·9, B 18·3 and C 17·4, out of a possible score of 31. On the remote test the scores are A 14·4, B 16·0 and C 15·3. Therefore, it may be said, the three groups are almost the same when tested for the actual content of the selection.

Under the same conditions a great deal more of the poem which was shorter and more 'interesting' was remembered than of the prose selection. The difference is not great on the preliminary tests, the average of the three groups on the poem (Table I) being 28 % and on the prose (Table II) 22 %, but after the learning period the average on the poem is 77 % and on the prose 37 %. On the objective tests the groups score on the poem about 0·85 of the possible score and on the prose about 0·3. The prose selection is, therefore, evidently more difficult. Although the absolute amount of content achieved differs in the two selections, the three groups on both selections are closely similar in the amount they achieve. Group A makes slightly the best achievement score on the poem, 55 %, with B 44 % and C 47 %; and slightly the worst on the more difficult prose selection, the achievement score being 13 %, with B 14 % and C 16 %.

Summarizing this discussion of quantitative differences, when results of verbatim and objective tests on both selections are considered, the differences in achievement of the actual material by the various groups is very slight. One method of learning achieves approximately as much of the content as another. One specific difference which may be noted is that when the group which has learned by the 'project' method is tested before the material is presented as a whole again, the achievement is considerably less than that of the other groups. A short additional period of 'drill' on the material brings this group to the standard of achievement of the other groups. This point, which has great pedagogical significance, will be expanded in a later section.

(2) *Qualitative differences.* Next, a qualitative analysis was made of what the children did with this material, when they were given a 'free' setting in which to use it. The children were asked to write stories (see procedure, p. 26). The directions were framed in such a way that the children could use the given material, expand it, or use material from other sources, objective or imaginative.

In reading the stories, differences among them were quite apparent. Some were highly imaginative, others merely repeated the given material, some were well organized, others confused. To show these differences several methods of analysis were attempted. Three will be mentioned

here. Of these the first two may be considered rough attempts to locate the differences, which are more clearly brought out in the final method.

The poem as given has no temporal or spatial setting. It might be about a pirate at any time and in any place. A temporal or spatial setting indicated by "one day", or "when I was on the sea", is something the child has developed in his story, himself. The number of children in each group who give either or both of these settings is shown in Table III. From this table we see that group A gives 18 settings, group B 39, and group C 54. Therefore, the more freedom in learning the children are given, the more they are able to give new forms (at least those of time and space) to the material.

Table III. *Number of pupils in each group giving a temporal or spatial setting to their story about Don Durk*

	Group A	Group B	Group C
Temporal setting	9	19	25
Spatial setting	9	20	29
Both settings	7	13	21
Total: Temporal and spatial	18	39	54

Indices of the amount of material from the poem and the amount of new material used by the child were obtained by counting the number of nouns in the stories which came from the given poem and the number of new nouns introduced. The average number of *old* nouns used by each group was A 9, B 6 and C 2. The average number of new nouns was A 4, B 7 and C 9. This, again, is an indication that the groups given more freedom in learning are less 'bounded' by the given material. They can use other sources in their stories and extend them to new situations.

The third method of analysis was to place each story into one of five categories. These categories were defined in terms of the extent to which the story was based on the given material and the extent to which it was constructed by the child. A description of each of the categories with an example of a story included in each is given below. Three of them contain stories which are constructed by the child and show originality.

Category 1. This contained 'stories' which consisted of nothing more than the poem in its original form. There is no difference between these stories and those obtained when a verbatim recall was requested.

Category 2. This contains stories modified only in change of pronoun. The poem is changed to the first person.

> I, Don Durk of Dowdee,
> I am as wicked as wicked could be,
> My coat it is crimson, etc.... (Group A.)

Category 3. This contains stories which are based on the given material but items are added to it.

"One day I was on my ship and the waves were pretty strong. I would turrel my mustache and down west the murmads splash. Oh it was fun to see them. I had plume on my hat that wobeled like that because it was so dangley and wobeley so sometimes it would make me laugh. I had a buccanear chest covered with mould, that was full of gold. I stole them off other ships but we had to fight for them. I was bold and bad but people said I was gorgies to see. We fought many battles at sea and many of us got killed. I took all the pearls I could find and chestes I could find and gold that was aboard. I the pirate bold and bad was killed to death at sea." (Group A.)

Category 4. Stories here are predominantly the child's own, but there is little organization or direction in them.

"I sailed the water in 1917 on the Mayflower. I had forty men. We went and robbed the mercents boat of five million dollars. We saw police. We hid the gold and ran. I was caut and we ran abord our ship and got arms. We fout and won. We settled down till the gold ran short and I got a job in a gold Mine, I set a time and we robbed the Mine and saild for Spain but ended up in England. Say it's one oclock. I must go now Sam and gang lets rob the safety bank tomorrow and divide the spoil and sail to Spain so long." (Group B.)

Category 5. Stories in this category are 'made up' by the child but the direction and organization is more definite than in category 4.

"I guess I'll tell you boys a story. Well as the ship pulled up her anchor and sailed of, I took a nice long nap. And I slept two days and two nights and then I woke up on the 2nd of June. And when I woke up I saw we were of the coast of Africa and were unloading the guns and amunition. And as we were doing this a British gunboat attached us. Well the battle lasted three days and we had took the sailors prisoners and we were going to make them walk the plank when Butch came along and said he saw a fleet of destroyers coming towards us full steam and were firing ten inch shells at us, so we hoisted our anchor and started sailing away full speed towards home and we reached shore just in time. We had sprung a leak so we jumped off the ship and ran to the fortress and here I am safe and sound."

Bull: "Gee what a story! That'll make a swell story book." (Group C.)

The number of stories written by each group are shown under the category to which they belong, in Table IV. The total number of stories belonging to the first three categories are, A 24, B 9 and C 2. The number belonging to the last two categories are, group A 11, B 29 and C 38. In the groups given more freedom in learning, there is less adherence to the form and content of the given material, more facility in relating it to material from other sources and greater organization into new forms and settings.

It should be noted that although these stories use new settings and contain nouns not found in the given material, they are never irrelevant

Table IV. *The number of stories developed by each group from* Don Durk, *which belong to one of five defined categories*, 39

	Group A	Group B	Group C
1. Poem	1	1	0
2. Poem changed to first person	16	4	0
3. Poem with additions	7	4	2
Total, based chiefly on given material	24	9	2
4. New story	2	9	4
5. New story (good plan)	9	20	34
Total, determined chiefly by the child	11	29	38

to the general theme—namely "piracy". This fact can be made apparent in this way. We gave each story a title. Selecting five titles at random from each group, the following list is obtained.

A	B	C
Getting the Boat	Sea Adventures	Exploring
Confused Sea-Battle	Planned Ships Robbery	Sea Battles
The Wealthy Ship	How the Pirate was Robbed	Dangerous Sea Life
Tragic Whaling	Showing off the Treasure	What Don did
Stealing the Chest	Don Durk's Life History	Robbery and Storm

Thus it is indicated that the children did not make up just any story—they centred it around piracy, the sea, battles and so on. There is a relationship with the general outline of the given material, not with the specific content.

The stories developed about *King John* were categorized in the same way.

Category 1. This contains those stories which are verbatim reports of the given selection.

Category 2. These are stories written from the viewpoint of a baron but including only material from the given selection. The change of pronoun is the main innovation.

Category 3. Stories heavily dominated by the given material, to which the writer adds material, or forms the story to include the baron as a real participant in the plot.

Category 4. Stories are included here which show the child's interpretation, and use of material from other sources.

Category 5. Stories which extend the topic to include other events and which maintain a definite viewpoint and good organization throughout.

It should be stressed that demarcation between the categories is not in any way absolute; the first three include stories based largely on the

given material, while the last two include those which show a new point of view, new material and new interpretation of the given material.

The number of stories in each category are shown under the three groups in Table V. This table shows that the number of stories dominated by the given material are 36 in group A, 31 in group B and 20 in group C. The number which show predominantly the influence of the child are, A 0, B 6 and C 19. This table shows the same general trend as Table IV. The groups given more 'freedom' in learning extend and augment the given material into new forms; moreover, they are able to maintain a new point of view in their story and use the given material in the new setting.

Table V. *The number of stories developed by each group from* King John, *which belong to one of five defined categories*

	Group A	Group B	Group C
1. Selection	3	7	6
2. Selection modified to first person	31	18	5
3. Selection with additions	2	6	9
Total	36	31	20
4. New interpretations	0	4	13
5. New interpretation with good plan	0	2	6
Total	0	6	19

Summarizing the discussion of qualitative differences, these three methods of analysing the stories show that the more opportunity the children have to participate in learning along lines of their own interest, the less bounded they are by the form and content of the given material. The ones given more freedom in learning can use the material in new ways, relate it to other material and re-construct it in new forms much more satisfactorily than the ones who were drilled on the given material. From this experiment the following conclusions may be drawn:

(1) Approximately the same amount of the actual material is remembered by all groups. However, when the children followed their own interests in learning, a review of the material as a whole was necessary in order to raise their verbatim recall score to the level attained by the other groups. We may conclude that children learn as many "facts of the given material" by the 'project' method of learning as they do when they memorize it by 'drill'.

(2) What the children made from the material becomes apparent in examining the differences which occurred when the children were given a

new setting in which it might be used. The procedure of setting a task which may be approached in many ways has been shown, in this experiment, to be a valuable method for focusing the "schematic differences in remembering". It was found that with more freedom and participation in learning, the schemata are less controlled by the given material, more adaptable to a new point of view, and more individualistic. When learning is based on definite instruction, the schemata reflect the material as it was given, and are stereotyped.

We may summarize these findings in this way: when learning is directed by the child's own interests, he not only achieves as much of the actual material, but is able to extend it into new forms required in other settings much more effectively than when the learning is based on instruction by the teacher.

The meaning we have given the concept of the schema, in earlier experiments, is supported and clarified by this experiment.

VII. Interpretation

(i) *The meaning of 'schema'*

At the beginning of this thesis the place of the concept of the schema in Bartlett's theory was described. The confusion resulting from his many uses of the term and the sources from which it developed were discussed. From experiments which studied remembering as an active process, an interpretation of the term was made. It has been used to designate "what the subject makes (creates or develops) from the given material (or situation)". This use does not coincide with any of Bartlett's four uses; schema is not used as a force, a subjective form, content or an apperceptive mass. It does, however, correspond very closely to the notion which we mentioned was pertinent to Wardian psychology:

> What is really retained is a kind of schema, a *plan of action.* ((6), p. 9.)

This thesis, using schema to mean "what the subject makes", may, in other words, be said to use it as the plan of the activity, the pattern of the subject's remembering, or "the form in which material is re-created". It, therefore, is appropriate to Ward's psychology and to Bartlett's theory of remembering.

According to Ward "experience is becoming expert by experiment". Learning in this psychology is therefore experience. Learning is a continual process. As a process it cannot be examined directly. At any

instant a cross-section of the existing relationships can be examined. When this is done it is found that the learning has 'form'. This form of learning is what we mean by schema. Learning not only has form, however; it has also direction. This cannot be obtained by examination at one instant. But a subsequent examination at a later instant will show a change in the schema. This change of form of schema from one examination to another may be the clue through which direction is understood. The schema influences learning, therefore, only in so far as form at one instant influences what form of relationships will evolve at a second. Learning and remembering are dynamic but their dynamics can only be inferred from various static photographs and the evolution of the schema gives a means of insight into the dynamic process itself.

When remembering is thought of as an active reorganizing process, the amount of given material which appears in the reorganization can, of course, be studied. We have suggested one method by which the other aspect of remembering—namely, what the reorganization is like—may be approached. This schematic aspect has important psychological significance both theoretical and clinical. Rather than the quantitative differences, the schematic differences—differences in what the individual has formed from his past experience, differences in the plan his activity takes—are of primary importance to the educator and to the psychiatrist. To be able to appraise what an individual makes from a given situation, enables one to know the interpretation he gives it and the significance it has for him, and this knowledge is necessary both for adequate clinical therapy and for satisfactory educational direction of the type desired in progressive educational philosophy, especially as it is embodied in the new *Programme of Studies* (10).

(ii) *Significance for education*

In a philosophy of education the ultimate aim of which is to fill the individual with a great number of disparate facts, hoping rather vaguely that sometime, by some process of association, they may become related, a psychology and methodology of the Ebbinghaus type is sufficient (7). The only aim of experimentation is to find the relationship between the number of facts which are given and the number which can be reproduced.

When education becomes interested not in the number of facts but in how the individual organizes and uses them, a psychology based on the notion that the activity of the individual is organizing in its very nature is necessary. Bartlett's psychology, which emphasizes the reorganizing

activity of the individual is highly pertinent to such a philosophy of education. A method within this psychology for studying reorganization is, of course, required. The meaning we have given to the concept of the schema in this thesis forms a basis for such a method, and its value has been tested by using it in examining reorganization in the practical educational field.

If our philosophy of education is based on the individual differences of children, and learning is directed along lines set by their individual needs and interests, appraisal can be made only in terms of what the individual actually achieves. Achievement can be only individualistic and considered relative to the child's abilities and interests. The notion of the schema suggests a means of evaluating what the child is achieving and, therefore, makes possible appraisal of the extent to which education is approximating its goals.

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DRAWINGS OF A MAN BY ADOLESCENTS

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I. Introduction

In 1924 I began an investigation of children's drawings, and a first report was published in the *British Journal of Psychology* in 1931(7). The investigation was completed in 1935, when a second report was prepared. In view of certain criticisms, however, publication was held up until I had had an opportunity of seeing the reports of other investigators working on this or allied subjects. The recent publication of Oeser's translation of Lowenfelt's *The Nature of Creative Activity*(5) seemed to make a suitable occasion for the revision of my own report.

The purpose of the investigation was the preparation of an objective method of examining children's drawings from the psychological and not the scholastic standpoint. At first the method used was that developed by Earl Barnes (1) and later by McCarty (6). This was to state a theme and to allow the children to illustrate it in any way they chose. The variety of interpretations was, of course, considerable, and the drawings were marked by comparison with standard drawings.

That seemed insufficiently objective and I had begun experimenting with a more specific subject—a man—when Goodenough's *Measurement of Intelligence by Drawing* (4) was published. She, too, had used this subject and had devised a scale of rather more than fifty points. Most of the early work in my own investigation consisted in trying out her scale with children in Aberdeen, Glasgow and Greenock. I came to the conclusion that her norms for American children were satisfactory for use in Scotland. The Goodenough scale is applicable to children up to 10 years of age. It is extrapolated up to 13 years. I formed the opinion, however, that the scale was not satisfactory for young adolescents, and it was with them that I was chiefly concerned for vocational guidance purposes.

In 1928, an opportunity for extending the study to cover young adolescents (10–14 years of age) presented itself in the National Institute of Industrial Psychology's Fife Experiment in Vocational Guidance (2). It was arranged that each of the 430 pupils should make a drawing of a man. The drawings were sent to me for marking. Later I discussed my interpretation of the drawing scores with Mr J. Kilgour, who was conducting the experiment, in the light of his experiences with the children and the impressions which he had formed of their personalities. Reference was also made to the children's other test results.

With the coming of adolescence, the child's drawing of a man undergoes considerable change and, at first sight, there may seem to have been deterioration in quality. Confidence has been lost; for instance, the line is now indecisive, and parts which are difficult to draw, such as the hands, are sketchily treated or omitted. But, although obvious features are lost and there is a falling off in logical arrangement, a subtlety previously absent may take their place.

The loss of confidence is largely due to the child's realization that his drawings are not good. He may have been told so many times but now he perceives the imperfections. Eventually, as he comes into closer contact with, and finally a part of, a new environment, he finds that the drawing game is not played by his associates. He knows that he is not good at it

and he gives up playing. After a few years he may maintain that he has "never" been able to draw, that it is a "splendid gift", and that he has "always envied people who can draw". Often, when he says that, he does himself less than justice.

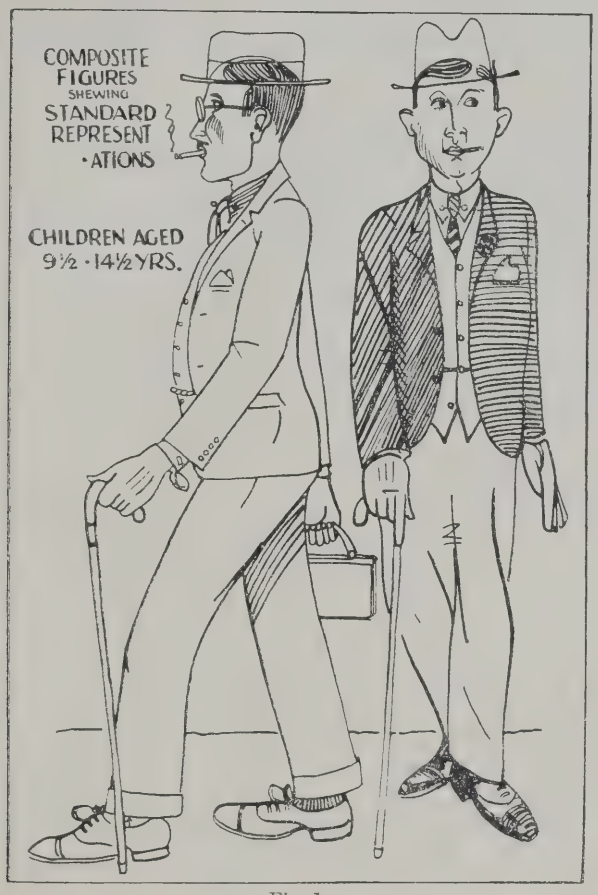


Fig. 1.

II. Preparation of the drawing scales

(1) *The points of the scale*

Two composite figures (Fig. 1) were prepared showing all of the items upon which it was thought points could be based. Three scales were prepared. The first followed the Goodenough scale fairly closely, and had fifty points. The intention had been to ascertain every possible way in which each selected detail could be drawn, and then to group together

those representations which had been used by the children who made the better drawings. It was found, however, that most good and bad representations were each of one kind, and other representations were so few in number, and so varied, that they did not lend themselves to statistical analysis. For the second scale a standard representation (for profile and for full-faced) was used for each point, and subjective judgments were made when deciding which of the other representations were and were not to score.

The fifty points were reduced to twenty in the preparation of the third (or final) scale. The other points were rejected for various reasons —some, such as the proportion of the size of the head to that of the trunk, seemed to be regarded by the adolescent as of little importance; some, such as the drawing of the hands, to which reference has been made already, were evaded by the adolescent because of the difficulty of making them life-like; some were scored by almost everyone and some were scored by almost no one; and in some cases the requirements of scoring had become so complex that I could not see how to state them clearly in a few words.

Twenty points may be considered too few for a standardized test. But this limited number makes for more convenient and perhaps more accurate marking. My difficulty was not, however, to find out how to reduce fifty to twenty points, but to determine twenty points, which, after they had been tried out and critically examined, could be considered reasonably satisfactory. I had hoped to arrive at twenty points, each of which would be scored by approximately the same number of persons. This did not materialize, and, while the distribution of points of the final scale, if arranged in order of difficulty, does give a linear curve, it has a marked gradient. Although the 'Standard Representations' are, in practice, of little importance, since other representations also score, they have been retained largely because they are useful when the scale is being memorized. All of the other representations may be regarded as modifications of the standard.

(2) *Full-faced drawings*

One of the greatest difficulties I experienced was to establish a balance between profile and full-faced drawings. Semi-profile drawings are rarely seen (0·4 %). Most of the drawings made in the immediate pre-adolescent years are profiles. During the first adolescent disturbances, there is a tendency to revert to the full-faced drawing of the pre-6½ year age group. (Of all the drawings made by boys, 13·2 % were full-faced,

and of those made by girls, 20·3 % were full-faced.) The quality of the full-faced drawing was usually inferior to that of the profile—particularly in the representations of the features of the face itself—but it is admitted that the final scale does tend to exaggerate the difference.

Before discussing the points with which the final scale has been formed, reference should be made to two other lines of enquiry followed during the investigation.

(3) *The coefficient of eccentricity*

When it was realized that some points were being scored much more frequently than others, the use of weighting was considered, but the distribution of the points did not suggest suitable groupings. It seemed that a measure of the degree of unusualness, exhibited by each child in the points which he scored, might be both interesting and useful. In some of the drawings, for instance, the total score, though small, was made up of points, such as numbers 14, 7, 19 and 20, which are rarely scored. In other cases a total of nine or ten was obtained in a quite orthodox way.

Accordingly a coefficient of eccentricity was used. For each drawing the number of *b* points scored (nos. 1, 2, 7, 9, 11, 14, 18, 19, and 20) were separated from the other or *a* points. The coefficient was the fraction, b/a. A high coefficient—over 0·60—indicated that there had been a considerable degree of unusualness in the way in which the points had been scored.

(4) *The index of adolescent disturbance*

An attempt was made to calculate an index of adolescent disturbance but it was not successful. This is, however, a useful approach to problems of adolescence, and to investigators who may use it in the future I pass on the following observations:

(1) The proportion of the height of the figure to that of the sheet of paper upon which it is drawn seems to have significance. The size of the sheet used in this experiment was 8 by 5 in., and distribution of the heights is shown in Table I.

Table I

in.	Boys %	Girls %
Up to 1	0	0
1–2	2·8	2·4
2–3	14·2	12·6
3–4	31·4	28·4
4–5	26·1	31·3
5–6	17·3	18·3
Over 6	8·2	7·0

The very small drawings made by some children are suggestive of lack of confidence, and this might be attributed to adolescent disturbance.

(2) The sheet of paper is sometimes turned so that the centre-line of the figure runs approximately parallel to the shorter instead of the longer side. I found this to be uncommon (occurring in less than 2 % of the drawings), and am inclined to regard it as more closely related to introversion than to adolescence. Possibly it has aesthetic significance.

(3) The drawing is sometimes left unfinished (there is no time limit in the test) and legs or arms—generally legs—are omitted. Detail is frequently quite absent except in the face, the figure being no more than an outline. The tendency, noted by Goodenough among younger children, to concentrate upon one part at the expense of the others, is common among adolescents. The face usually receives most attention. The index I used of the size of the head was that it should not be more than one-half or less than one-quarter the area of the trunk.

(4) Noticeable features of adolescent drawings are twisted and stunted hands and fingers; and twisted, stunted or elongated, and very thin arms.

(5) The omission of the sleeves might have significance—the break at the cuff-line is not shown, and the hand is not separated from the arm. The hand itself may be omitted.

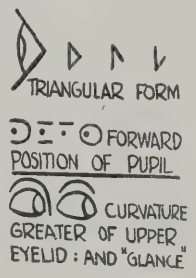
(6) The omission of the collar, or, indeed of any line at the neck separating the head from the body, is also an interesting feature of some drawings.

(7) The lines tend to be indecisive, sketchy and broken in comparison with those of younger children.

III. The scale finally adopted

(1) *Description of points*

No. **1**. *The eyes. Requirements for scoring: profile—either triangular form or forward position of pupil. Full-faced—either curvature of upper eyelid greater than that of lower eyelid; or 'glance'.*



The triangular form used in profile drawings is appropriated directly, in my opinion, from drawings printed in books and periodicals. Many black-and-white artists try to represent facial details with as few lines as possible, and the omission of the lower eyelid is among their commonest devices. This simple angular form is probably adopted by most of the children because it 'looks right', and without an attempt being made to find out *why* it looks right. Generally, the upper and lower eyelids are shown as symmetrical. The term 'glance' used in reference to the full-faced representations is self-explanatory (Fig. 2 (5)). Sometimes there are squints, the glances in the two eyes not being identical. The examiner has then to decide whether glance is really intended, or whether an accidental effect has been obtained by bad drawing. In some instances the decision is influenced by the general impression formed of the whole figure. "Is this a child likely to include glance?" The outstanding difficulty in marking point 1 is deciding when the pupil is in 'a forward position'.

Point 1 was scored by 26·0 % of the boys, and by 31·6 % of the girls. Of the full-faced drawings, 10·5 % of those made by boys, and 12·3 % of those made by girls scored the point.

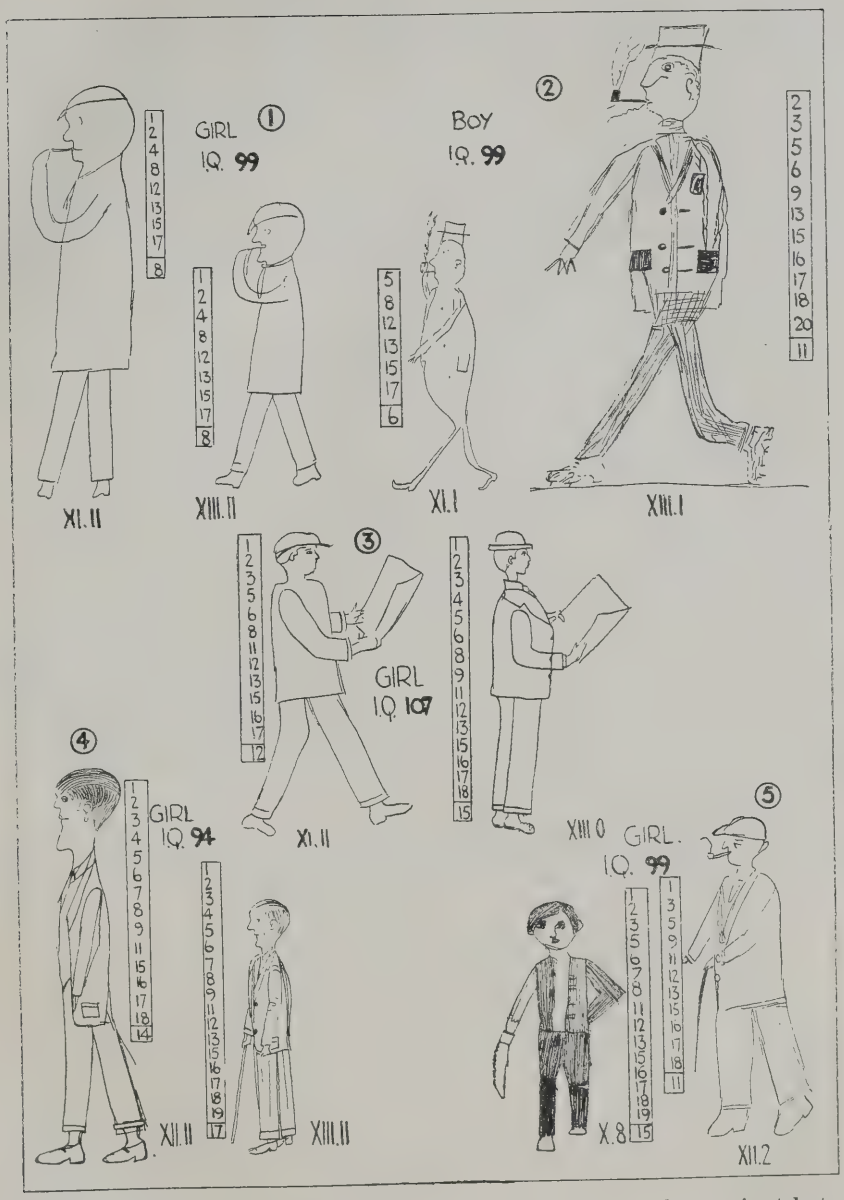
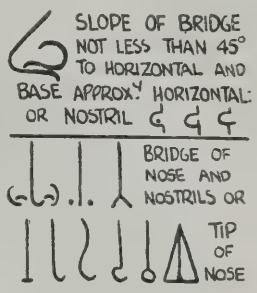


Fig. 2. Drawings of 'a man' made by five pupils after an interval of approximately two years. The points scored and the total scores are shown for each drawing. (Drawings reduced to 0·37 of original height.)

No. 2. The nose. Profile—either slope of bridge of nose not less than 45° to horizontal, and base approximately horizontal; or nostril shown. Full-faced—bridge of nose and either nostrils or tip of nose shown.

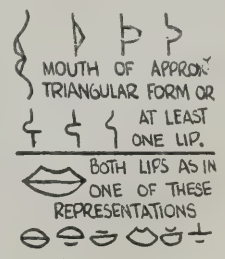

SLOPE OF BRIDGE NOT LESS THAN 45° TO HORIZONTAL AND BASE APPROX.Y HORIZONTAL OR NOSTRIL
BRIDGE OF NOSE AND NOSTRILS OR
TIP OF NOSE

All details of the face, with one exception, were difficult to mark, and there was the further complication that in the full-faced drawings the facial details are more frequently scamped than in the profile drawings. This point was particularly troublesome. The maximum angle of the bridge of the nose to the horizontal was at first fixed at 80°; with a permissible range (12° above horizontal and 30° below horizontal) for the slope of the base of the nose. A comparison was also made between the area of the nose and the area of the face as a whole. Normally a human being's nose is approximately the same shape as a 60° set-square. But variations in shape and in size are so considerable that the examiner sometimes has to deduce from the manner in which the rest of the drawing has been made, whether, let us say, a peculiarly aquiline form—possibly resembling a beak rather than a nose—is deliberate or merely fortuitous (Fig. 2 (3)). Finally, the conditions were considerably simplified. Possibly it would have been better to have abandoned altogether the reference to the shape of the nose and to have substituted a requirement about the line of the base of the nose continuing inwards from the outline of the face (Fig. 2 (2)).

It was found that requirements for scoring the full-faced representation were no easier to devise. The flat triangular form was rejected—although I know that there actually are such noses—except when the bridge was shown too. The tip (or the base) of the nose may be shown in many ways, and the drawings have been treated generously (Fig. 2 (5)). The peculiar *w* and *m* bases were scored when the bridge also is included—they are probably relics of the decorative treatments found sometimes in the drawings of younger children.

Point 2 was scored by 26·7 % of the boys, and by only 16·3 % of the girls. Full-faced drawings in which this point was scored were made by 26·3 % of the boys, and by 27·2 % of the girls.

No. 3. The lips. Profile—either the mouth of approximately triangular form or at least one lip shown. Full-faced—both lips shown as in one of the representations on this page.



Most writers of papers about children's drawings have commented on the careless way in which the mouth is drawn. Indeed, in this instance, the representation chosen as the standard was reproduced in fewer than 1 % of the drawings. Lips are rarely shown in the profiles (Fig. 2 (4)) and, after the drawings had been marked for the first time, it was realized that the inclusion of lips could not be made the only condition for scoring and that another and more easily satisfied requirement must be used. This accounts for the inclusion of the opening of the mouth.

A profile representation which should not be allowed to score is that in which the

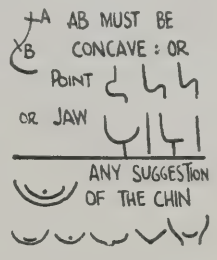
outline of the face from the nose to the chin is a straight line, the mouth being inserted later by one or more short dashes. Even after this had been excluded, however, the modified requirement for the point was now so readily met—and sometimes by representations which could not be considered at all good—that, when preparing the final scale, I seriously considered discarding the point altogether and substituting another, such as the inclusion of eyebrows.

As, however, the lips provide a satisfactory item in the marking of full-faced drawings, the point was retained, with conditions as they now appear in the scale. The only difficulty met with in the full-faced representations is caused by smudged lines made when badly sharpened pencils are used. It is occasionally impossible to make out any of the details.

This point was scored by 63·0 % of the boys, and by 67·1 % of the girls. In the full-faced drawings 33·3 % of the boys and 30·9 % of the girls scored.

The differences between the percentages for the profile and full-faced drawings are marked and this is one of the weaknesses of the final scale.

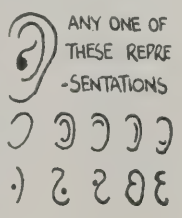
No. 4. The chin. Profile—chin between lips and point concave; or point or jaw shown. Full-faced—any deliberate indication of chin scores. A beard or other device obscuring chin does not score.



Difficulties in marking this point are also caused by the use of soft, unsharpened pencils, and by the minuteness of some of the drawings. The requirements that the curve *AB* shall be concave is searching. But if I had to prepare another scale, I should experiment with a combination of the point and the jaw. Indeed, the original conditions have already been broadened to include these features, but they are more suitable for the profile drawing than for the full-faced drawing.

The point was scored by 36·7 % of the boys, and by 47·5 % of the girls. It was less frequently scored in the full-faced drawings—by 19·3 % of the boys and 9·9 % of the girls.

No. 5. The ear. Any one of the representations shown on this page scores.



Requirements to be met in scoring this point were comparatively straightforward. The first was simply that there should be an ear—it is astonishingly frequently missed out. The minimum amount of detail which could be considered satisfactory had also to be determined. Within my experience the lobe and the concha have been shown only very rarely by young adolescents (a fraction of 1 %) in, at least, a recognizable form. The entrance to the auditory canal—the 'earhole'—appears in rather more than 8 % of the drawings and the outer 'curl' of the auricle is shown by means of a double line in approximately 15 % of the drawings.

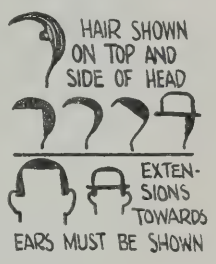
The inclusion of any one of these details was allowed in scoring the point. A reasonably good attempt to shape the outline of the ear was also recognized and for this the essential requirement was an approximately triangular shape with a fairly

acute angle at the lobe. Some of the attempts to represent this oddly-shaped organ are amusing, and I dealt with the '3' and the '*S*' forms generously (Fig. 2 (2)).

The representations of the ear made by the children in the profile and full-faced drawings are very much alike, but it is interesting to note that the point is less frequently scored in the latter. Perhaps the simple outline of the full-face, as compared with the greater complexity of the profile-face, leads to a scamping of details.

The point was scored by 43·4 % of the boys, and by 39·7 % of the girls; but in the full-faced drawings alone by only 31·5 % of the boys and 21·0 % of the girls.

Nos. 6 *and* 7. *The hair. Point* 6*—hair covering top and part of side or back of head. Where hat is worn, the point is scored if hair is shown between hat and ear. Point* 7*—hair represented as brushed by means of directed lines with perhaps a suggestion of shading by tone. Scrawl does not score.*



In many drawings the men are quite bald (Fig. 2 (2)), and in only a few is an attempt made to represent the hair by any other means than dots, dashes or scrawl. The sketchiness of the drawing and the absence of outline makes the marking of point 6 more difficult than may be expected.

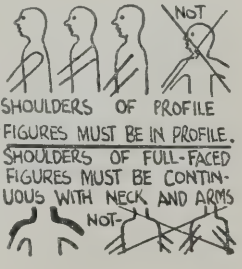
The point was scored by 43·2 % of the boys, and by 57·8 % of the girls. In the full-faced drawings there was again a considerable—a very considerable—fall in the numbers of children scoring the point—17·5 % of the boys, and 32·1 % of the girls.

When scoring point 6, I dealt with the drawings generously but, for point 7, I dealt with them quite severely. The amount of attention given by different children to the drawing of the hair varies considerably. Some—5 %, mostly girls—make it the outstanding item (Fig. 2 (4)). Others show the hair in quite a pleasing way, two or three being 'slick' in the professional manner. The more painstaking children direct the shading and, by using solid black, carefully show the hair brushed and shining, with a clearly defined parting and possibly also a tuft at the crown.

Accordingly, in preparing the final scale, a point which was regarded as unsatisfactory in the second scale was replaced by a new point requiring the head to be not only well covered with hair, but with hair which had been brushed. The shading should be directed to follow the outline of the head.

I gave a score for this point to about 8 % of the drawings.

No. 8. *The shoulder. Profile—shoulders shown in profile. Arm must be represented by double line. Full-faced—shoulders continuous with neck and arms.*


NOT
SHOULDERS OF PROFILE FIGURES MUST BE IN PROFILE.
SHOULDERS OF FULL-FACED FIGURES MUST BE CONTINUOUS WITH NECK AND ARMS
NOT

The amusing incongruity of the double nose in the mixed profile, which characterizes the drawings of children from 6½ to 7 years of age, has tended to divert attention from the discussions on its significance. Although the head and the legs complete the turn from full-faced to profile during a comparatively few months,

the trunk might never leave the front position (Fig. 2 (2)). The way of showing the shoulders in a profile drawing (i.e. a drawing in which the head and feet are shown in profile) provides, therefore, a very useful measure of the quality of children's drawings.

There is no corresponding distortion in the full-faced drawings (i.e. a drawing in which the head and trunk are shown in front view). Accordingly, another requirement had to be substituted, and it is that the shoulder should be continuous with the arm and neck.

The point was scored by 70·4 % of the boys, and by 69·6 % of the girls. In the full-faced drawings it was scored by 61·4 % of the boys, and by 64·2 % of the girls.

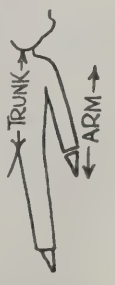
No. 9. *Lapels of coat. Lapel must be clearly defined and not open to confusion with collar. Collar does not score, not even in costumes.*

The lapel was originally just one of the many items included among the requirements for scoring points 17 and 18. But I soon realized that it had greater significance than most, and perhaps all, other details of clothing. In the final scale the lapel has been made a separate point, and the requirements for scoring have not given rise to difficulties. The only feature causing doubt is the occasional uncertainty as to whether the child intended to show a lapel or collar.

In costume drawings lapels would be sometimes inappropriate and their omission cannot be treated as a fault. At first, in these circumstances, the collar was allowed to take the place of the lapel, and a score given for its inclusion. This caused further difficulty, and I decided to mark the point severely, allowing a collar to score only when the accuracy of its representation and the treatment of adjoining parts suggested that the lapels had been left out deliberately.

The point was less frequently scored than one might have expected —by 20·9 % of the boys, and by 35·2 % of the girls. In the full-faced drawings it was scored by 21·0 % of the boys, and by 27·2 % of the girls. It will be noticed that the girls score this point (a detail of clothing) more frequently than do the boys.

No. 10. *Length of arm equal to or slightly longer than length of trunk; but not more than* $1\frac{1}{4}$ *times its length.*

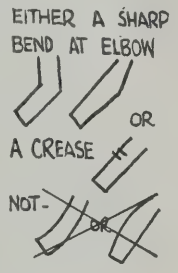


The relative sizes of different parts of the figure provide some very useful points in marking the drawings of young children; but they seem to have less significance in the drawings made by some adolescents. Until the preparation of the final scale, two points were retained based upon comparisons between sizes—the arms to the trunk and the legs to the trunk. The second of these was quite unsatisfactory. The conditions had to be made either so wide that almost all the children scored, or so restricted that the 'wrong ones' often scored when the 'right ones' did not. I think that the length of the leg is a very variable detail in the schema of an adolescent child's drawing of a man (Fig. 2 (2)). The legs are the last of the limbs of the body. Their length is, therefore, quite likely to be determined by chance. This criticism applies, although to a lesser extent to the relative lengths of arms and trunk.

The point was scored by 38·5 % of the boys, and by 32·7 % of the girls. In the full-faced drawings it was scored by 52·6 % of the boys and by 37·0 % of the girls.

No. 11. *The elbow. Either a sharp bend at elbow or a crease at elbow.*

The requirement for scoring this point is quite definite, although in practice some latitude has to be allowed in interpreting the word 'sharp'. A few cases have been credited in which there was no abrupt bend at the elbow, but the 'skeleton' lines from the shoulder to the elbow and from the elbow to the hands formed a distinct angle.



The point was scored by 29·1 % of the boys, and by 27·1 % of the girls. In the full-faced drawings it was scored by 26·3 % of the boys, and by 22·2 % of the girls.

No. 12. *The hand: action. Any activity with hands scores, including holding an article or two hands clasped together. The hands need not be well drawn. Arms parallel to sides or outstretched do not score, as they have probably been placed in these positions simply because they must be placed somewhere.*

The representation of activity in a drawing is important, a 'living' figure seeming to be psychologically more significant than a mere schematic form (Fig. 2 (5)). An exceptional feature about this point is that older children score it less frequently than younger children. Any kind of action is given a score but sometimes it is difficult to decide whether action has really been intended by the child. For instance, he has to put the arms somewhere, and figures standing at attention, or with outstretched welcoming arms, or with arms akimbo, or with downward stretched arms suggestive of despair, are merely formal and do not really signify action sufficiently clearly to score this point.

Requirements to cover all possible arrangements cannot be devised, and the examiner must sometimes make subjective judgments when scoring this point. Actually, however, there is only rarely serious doubt about a child's intention.

The point was scored by 33·5 % of the boys, and by 32·9 % of the girls. In the full-faced drawings it was scored by 26·3 % of the boys, and by 35·8 % of the girls.

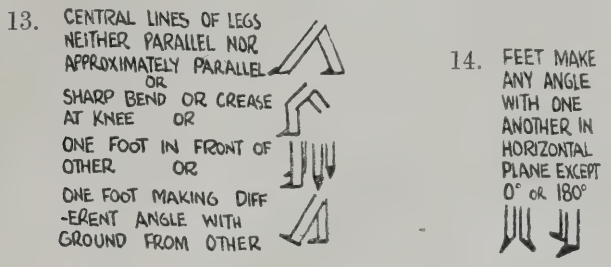
Nos. 13, 14, *and* 15. *The feet. Requirements for scoring points* 13 *and* 14 *are shown on p.* 49. *Requirement for scoring point* 15 *is any form of heel or at least one foot not in profile and foreshortening attempted.*

While the length of the legs is not considered to be an important feature of an adolescent child's drawing, the treatment of the feet has more significance. No less than three points have been allotted to it.

Point 15 requires no explanation, the importance of including the heel and showing the foreshortening of the foot having been generally recognized (Fig. 2 (5)).

Point 14 covers all variations of the usual 0° and 180° schema. Point 13 has been included to cover activity with the feet. Only 1 % of the children scored all three

points, but the combination of points 13 and 15 is found in a considerable number of the drawings.


13.
CENTRAL LINES OF LEGS NEITHER PARALLEL NOR APPROXIMATELY PARALLEL
OR
SHARP BEND OR CREASE AT KNEE OR
ONE FOOT IN FRONT OF OTHER OR
ONE FOOT MAKING DIFF -ERENT ANGLE WITH GROUND FROM OTHER
14.
FEET MAKE ANY ANGLE WITH ONE ANOTHER IN HORIZONTAL PLANE EXCEPT 0° OR 180°

Various ways in which activity with the feet may be represented are shown above, and any one scores point 13. The options cover a wide range, but it will be found that they all apply to an activity with the feet. A few children qualify to score this point in more than one way (Fig. 2 (2)), but, of course, they are not awarded more than one point.

Placing one leg in front of the other is probably more significant than the other ways of scoring point 13. For instance, contrast the pairs of drawings (2), (3) and (4) in Fig. 2. The scale might have been improved by separating this, and making another point with it.

The number of children scoring the three points are shown in Table II.

Table II

	Boys		Girls	
No.	All drawings %	Full-faced %	All drawings %	Full-faced %
13	54·5	10·5	36·4	6·2
14	4·2	17·5	5·5	9·9
15	75·3	71·8	78·9	69·2

Point 13 was expected to favour the profile drawings, but point 14 was intended to restore the balance, and this has been to some extent achieved.

Nos. **16, 17,** *and* **18.** *Clothes. Point* **16.** *Ends of sleeves* and *trousers clearly marked. Point* **17.** *At least one of the articles mentioned below shown. Point* **18.** *At least three of these articles shown.*

One, but usually not more than one, of the many clothing details associated with the basic schema is included by most children. They may be regarded as of trivial importance, or as bearing closely on the ideas which the children are trying to express in their drawings. These articles are: hat-band, parting in hair, eyelashes, spectacles, beard, moustache, cheeks (shaded), pipe, cigarette, tie, collar-pin, stud, watch-chain, cuff-links, cuffs, button-*holes*, handkerchief, trouser-crease, trouser turn-up, pocket, knot in tie, knot in shoe lace, sole of shoe (see Fig. 1).

The drawings may be classified according to the attention given to clothing and activity. There are six general groups, although this number does not cover all the possible subdivisions:

(*a*) Purely formal, no associated details of clothing and no activity: boys 32·6 %; girls 24·3 %.

(*b*) Purely formal in that there is no attempt to show either costume or activity, but a detail has been shown of a colourless character, such as a pipe, moustache, tie-knot or boot-lace: boys 28·4 %; girls 43·9 %.

(*c*) Purely formal in that there is no attempt to show *costume*, but there is orthodox activity to the extent of the man carrying something (generally a stick, umbrella, or bag), walking, running, etc.: boys 16·3 %; girls 21·7 %.

(*d*) As in (*c*), but attempt is made to show 'meaningful' activity (boxing, shovelling, etc.): boys 4·4 %; girls 3·8 %.

(*e*) Character (clearly defined: not merely, say, a beard) or costume, but without 'meaningful' activity: boys 13·9 %; girls 5·8 %.

(*f*) Character or costume and 'meaningful' activity: boys 4·4 %; girls 0·5 %.

The differences between the two sexes are most interesting. It must be said that, compared to the drawings made by the boys, those of the girls tend to be unimaginative. There are fewer character and costume drawings, and action rarely gets beyond carrying a stick or umbrella. This might mean no more, however, than that the subject of 'a man' is not well suited to girls, and that for them it should have been changed to 'a woman' or, better still, to 'a girl'.

As the children who focus their attention on the costume may take little interest in the figure itself, they often do poorly at some of the other points. The scale may deal with them a little unfairly. Another point was considered requiring the inclusion of *six* or more items of dress. But in making such allowances one encounters another difficulty. The details in costume drawings are not adequately covered by the list—there are clogs, shawls, daggers, etc. The preparation of a list to cover all of them is quite impossible.

The "ends of the sleeves and trousers" have been made the requirement of a separate point, and this has been, in my opinion, one of the most useful in the series.

The numbers of children scoring these points are shown in Table III.

Table III

	Boys		Girls	
No.	All drawings %	Full-faced %	All drawings %	Full-faced %
16	52·0	52·6	63·6	55·5
17	67·5	63·2	75·6	69·2
18	25·8	40·3	23·6	30·9

No. 19. *Shading: Creases. Shading by tone differences or by line direction on two adjacent parts, other than hair, boots, and background, to distinguish them from one another; or shading to represent shadow; or at least one crease in clothes or face.*

The use of shading to represent shadow is certainly worthy of recognition. An allowance for showing creases (Fig. 2 (4)) has been added to it. The crease is no less significant than the shadow, but one of its commonest appearances—at the elbow—has been already recognized. The requirements for points 11 and 19, as they are given in the scale, permit of its scoring twice.

It must be admitted that the decision to include creases in the requirements for point 19 was influenced partly by the fact that, in practice, the situation is rarely met. Appreciation of the use of creases usually goes with that of shadow, and the two are frequently found together in the same drawing. The crease seems to precede the shadow in development, but it is used with less skill. It is included, I think, quite often because it 'looks right' rather than because it is really understood.

Greater difficulty was experienced in deciding if a score should be given for shading when it represents not shadow but differences in tone—as, perhaps, between the materials of which the jacket and the waistcoat are made (Fig. 2 (5)).

No less than 3 % of the children use shading of this type, but sometimes its purpose is, very obviously, to hide deficiencies in their drawing. It is quite often employed by mental-defectives. A uniform light grey tone was placed over the whole or most of the figure by approximately 1 % of the children, possibly in an attempt to get a 'realistic' effect. This is one of the practices which seem to go by 'schools'—it is much more common in some than in others.

The conditions are severe, for details, such as the hair, the hat, and the boots with which shading is readily associated, are excluded. Few children succeed in meeting the requirements.

The point was scored by 11·4 % of the boys, and by 7·0 % of the girls. In the full-faced drawings 17·5 % of the boys, and 8·6 % of the girls scored the point.

No. 20. *Background. Any attempt, no matter how slight, to indicate background apart from the figure. The presence of a second figure of any kind is sufficient.*

Background (Fig. 2 (2)) is one of the most readily observable features of a drawing and its inclusion is recognized as important by all, or almost all, investigators.

Any form of background meets the requirements for this point, which was scored by 19·3 % of the boys and by 10·6 % of the girls. In the full-faced drawings 26·3 % of the boys, and 16·1 % of the girls scored this point.

(2) *What the scale is and is not intended to measure*

At this stage it is perhaps advisable to mention again what this scale is and, incidentally, what it is not intended to measure. The points are based upon characteristics and details which the young adolescent could have observed in other people's drawings of men and appropriated—for instance, a way of showing an eyelid or a crease. The points do not necessarily relate to the aesthetic merit of the drawings.

The ability to draw a man has to be acquired by the child. He is unlikely to be taught at school how to draw a man. Indeed, it is occasionally true to say that children learn to draw men in spite of their art teachers. I would emphasize this point because the general public does not realize that there are many different branches of art. The artists best qualified to express an opinion on whether a series of drawings has been fairly evaluated by means of the scale described here are cartoonists and magazine illustrators.

I have become accustomed to the surprise that this suggestion arouses and I have heard it lead to a discussion on whether a cartoonist is really an artist at all. That is, however, to miss the point completely. The question of whether it is desirable for children to copy the work of cartoonists is outside the scope of this paper. The point is that that is how they do learn to draw men.

This test is, accordingly, very different from tests based upon the treatment and content of children's drawings of imaginative subjects. Such tests afford opportunities for studying the gradual shaping of interests and ideas, particularly of pre-adolescent pupils, and I strongly advocate their use. The test of drawing a man is supplementary to them, or perhaps it would be more accurate to say that, for adolescents, they are supplementary to it.

It is a mistake, however, to apply the scale to the drawing of a man included in an illustration of a theme. A separate drawing must be obtained in which the child has focused his attention on drawing one particular man.

IV. Analysis of scoring

(1) *Distribution of total scores*

The distributions of total scores are shown graphically in Fig. 3. There is a tendency, although not statistically significant, for the scores to be slightly higher for girls than for boys. The boys make more very bad and very good drawings than the girls do.

Regarding all of the ages 10–14 as forming one group, the scores may be graded as follows: 0, 1, 2 (i.e. up to 11 percentile) poor; 3, 4, 5 (up to 36 percentile) fair; 6, 7, 8, 9 (up to 67 percentile) average; 10, 11, 12, 13 (up to 91 percentile) very good; 14–20 excellent.

An examination was made of the possibility of obtaining correlations of the total scores with chronological ages, mental age being kept constant, but the material was unsuitable. It can, however, be said, as an indication, that the correlations were of a low order, generally little above zero.

(2) *Feminine characteristics*

The chief feminine characteristics I observed were:

The fine rather delicate line.

Attention given to shaping the outline. The figures sometimes have feminine contours.

Inclusion of greater detail, particularly of the face and of clothing.

Saucer-shaped eyes, too big for area of face.

Small noses. Comic noses, which are often seen in boys' drawings, are hardly ever seen in girls' drawings.

Greater attention to mouth, including perhaps 'cupid's bow lips'.

Hair drawn more carefully than in boys' drawings.

Arms and legs too thin.

Feet too small.

Very unreal representations of such masculine properties as beards and pipes.

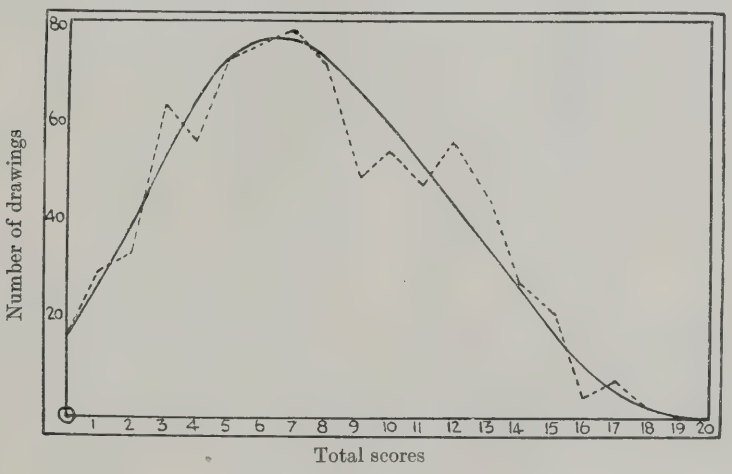


Fig. 3. Distribution of total scores. It will be noted that the reduction of the number of points to twenty has been responsible for some children scoring very low marks.

(3) *Differences due to different social environments*

Three of the six schools included in the experiment, A, B, and C, were in the country, and the other three, Z, Y, and X, were in the town (Dunfermline). The central three of the Registrar-General's five social classes were represented in the experiment. The children attending schools A and C came mostly from the homes of farm labourers in comparatively sparsely populated districts. The village B was more compact and, therefore, more of a community than were the other two villages. Further, it was situated near a fairly large and prosperous industrial town (Kirkcaldy). The children attending Z were drawn mainly from the profes-

sional classes. Those attending X were from the poorer classes and some of the parents were unemployed at the time of the investigation. The other school Y was more mixed. There was a prominent country element, the school being on the outskirts of the town. The fathers of many of the other children were tradesmen. The schools were to be ranked socially in the order Z, Y, and X.

The mean drawing scores and also the mean I.Q.'s for the boys and for the girls of these six schools are given in Table IV. In calculating these means, the *last* drawing score made by each child has been used. Thus the ages of almost all of the children come within the thirteen-year-old group.

Table IV

School	No. of children	Mean drawing score	Mean I.Q. (Binet)
A. Boys	19	5·47±0·53	91
Girls	16	6·13 0·45	93
B. Boys	21	6·23 0·55	93
Girls	21	7·14 0·53	95
C. Boys	34	7·90 0·49	96
Girls	28	7·92 0·49	100
Z. Boys	41	10·63 0·38	109
Girls	48	10·58 0·33	112
Y. Boys	70	8·58 0·32	99
Girls	44	7·48 0·40	97
X. Boys	56	7·68 0·35	91
Girls	71	7·53 0·29	94

Although in each instance the number of children is small, the difference between the drawing score means of (Z) and those of the other schools, and especially the country schools, may be regarded as significant. The smallest difference between the means is for the boys of (Z) and (Y), i.e. 2·05. The P.E. of this difference is 0·50. Accordingly it may be said that the ability to draw a man is influenced by social factors —perhaps, simply that the drawing game is most often played and encouraged in the homes of fairly well-to-do people.

(4) *Coefficient of consistency, a measure of reliability*

As is mentioned elsewhere, there is a tendency, not quite general, for the total scores made when the test was done for the second time (usually after an interval of two years) to be slightly higher than those for the first attempt. Coefficients of consistency were calculated to show the extent to which the key numbers of the points scored in the first drawing were the same as those scored in the second. The coefficients were rarely less than 0·6.

V. Other available scores

One of the chief purposes of the Fife experiment (2) was to examine a large number of tests. It was begun in 1928 and was of six years' duration. The work of the first period of three years was mainly testing, and of the last three years mainly following up.

Some children were examined only once (those aged 13 years in 1928–9), others twice and a few three times. Generally there was a gap of two years between the first and second testing. As the experiment was limited to the group formed at the start, it followed that the 12- and, particularly, the 13-year age groups contained many more drawings than the 10-, 11- and 14-year age groups.

The correlations (by age groups) of the drawing scores and the scores obtained at certain other tests are given in Table V. The number of cases varies slightly with different tests on account of school-absences, and there are a few drawings for which I did not have any other test scores.

Table V. *Table showing correlations of drawing scores with performances at other tests*

(All correlations are positive)

	No. of cases	Mental age (Binet)	N.I.I.P. test no. 34	Form relations	Memory for designs	Cube construction	Pictorial completion	Mechanical assembling
10 yr.–10 yr. 11 mo. (boys and girls)	35–39	0·23	0·43	0·15	0·12	0·22	0·06	*
11 yr.–11 yr. 11 mo. (boys)	86–88	0·39	0·38	0·39	0·51	0·32	0·24	0·25
11 yr.–11 yr. 11 mo. (girls)	80–90	0·44	0·50	0·38	0·47	0·25	0·36	0·16
12 yr.–12 yr. 11 mo. (boys)	95–97	0·60	0·50	0·58	0·59	0·35	0·50	0·40
12 yr.–12 yr. 11 mo. (girls)	94–108	0·70	0·58	0·55	0·60	0·40	0·42	0·31
13 yr.–13 yr. 11 mo. (boys)	172–180	0·39	0·38	0·38	0·49	0·21	0·38	0·18
13 yr.–13 yr. 11 mo. (girls)	151–162	0·59	0·55	0·41	0·53	0·37	0·34	0·31
14 yr.–14 yr. 11 mo. (boys and girls)	29–40	0·40	0·40	0·17	0·52	0·30	0·35	*

* Not given owing to markedly different standards required for boys and girls.

VI. Interpretation of scores

(1) *Abilities*

The correlations of drawing scores with intelligence are fairly high. Intelligence is certainly an important factor in determining the ability to draw a man. It is a mistake, however, to treat a drawing test (at least of the kind described in this paper) as a test of intelligence.

The I.Q.'s (Binet) of the pupils with very high drawing scores (over 15) were: 117, 116, 115, 112, 112, 110, 108, 108, 103, 94 and 89. Against this may be set children whose score was under 5 and whose I.Q.'s were: 127, 120,

118, 118, 116, 115, 115, 114, and 111. The position with children whose drawing scores were high (13–15) is: I.Q. over 120 (7 children); 110–119 (27 children); 100–109 (21 children); 90–99 (8 children); 80–89 (10 children).

The correlations with certain tests of visual abilities, notably memory for designs, are fairly high. This may be attributed simply to the feeling of confidence with which a person who is accustomed to draw frequently might approach such a test; or it may be regarded as giving some support to the theory of the existence of a 'visile' type.

(2) *Subjective and objective attitudes in drawing*

During recent decades much attention has been given, particularly by members of the German psychological schools (see Lowenfelt (5), pp. 130–48), to two distinct styles in art. Various terms have been used to describe them, such as Kühn's 'sensorial and imaginative'. One artist, it is said, tries to portray what is sensorially perceptible. He copies reality, imitates nature. The other artist tries to draw what is experienced inwardly and this leads him to adopt *inter alia* ornamental treatment. In the face, for instance, the eyebrows combined with the nose, and perhaps the eyes, lend themselves to ornamental representation, and, where facial expressions are repeated, fixed ornamental forms may arise.

The pupil who does well at a test of drawing a man is probably of the sensorial type, particularly if he does much less well at imaginative drawing. The children who took part in this experiment did not do any imaginative drawing, so I have no data available on this point. I did not lack, however, personal opinions about it, for the number of persons who have at various stages in this investigation told me that I was working along the wrong lines was quite large. Reference was made in their criticisms to exhibitions of children's drawings—often from Central Europe—which have recently been held in many towns. These delightful drawings are generally of the imaginative kind, vividly coloured in crayon. Once a teacher told me how surprised she was to learn that I did not like to be given a drawing made with a very soft pencil. That, she said, was just what she recommended her pupils to use. Usually, however, the criticism was directed at the supposed analysis of one small part of a picture to the exclusion of all consideration of the ideas expressed by the child, his symbolism, his harmony, etc. My explanation that the child was asked to draw only a man and not to develop a theme was rarely well received, and I am afraid that several of my critics still think that the real reason why I restricted the subject to 'a man' was to make the marking simpler.

(3) *Indirect social interests*

The imaginative drawing is much more suggestive of introversion than the sensorial drawing. There is, accordingly, an implication that the child, whose drawing of a man obtains a good score when marked by the final scale, is likely to be more extraverted than the child whose drawing is highly imaginative.

However, he is, as I see him, a rather unusual kind of extravert. His interest is clearly in people instead of in things, but he likes to make indirect contact with them. He likes to be present on social occasions, so that he may feel he is taking part, rather than actually taking part. If someone pleases him—perhaps a film star—he tries to draw her. If someone annoys him—perhaps a teacher—he attempts to caricature her.

Probably there are really quite a large number of extraverts who seek in various ways to make indirect rather than direct social contacts. Few apparently find drawing of use to them, for most give up the drawing game altogether. But some do not, and it is interesting to speculate as to why they continue to play the drawing game.

Perhaps the most remarkable feature of the pairs of drawings obtained in this experiment is the persistence of the schemas. Four of the pairs of drawings in Fig. 2 show that, after a period of two years, the young adolescent reproduces an almost identical drawing. These examples are in no way exceptional. This persistence is commoner among drawings of average or less than average quality than among the good drawings; but it is to be seen even in Fig. 2. It seems almost incredible that every time these pupils drew a man during the interval of two years they used the same schema. That is, however, the conclusion to which anyone who studies this collection of drawings must come.

This apparently means that, whatever may have been the original reason for the child adopting and developing his own schema, its repetition has become quite formal. Accordingly, I examined the possibility that the children who did the best drawings were actually 'showing off'. Their drawing of a man is perhaps their outstanding accomplishment, and when they display their skill they might be deriving satisfaction from the interest they arouse. Even when they are alone and repeat the drawing, they might be hearing again the praise which this ability has won for them. Accordingly, I studied what was known about the characters, abilities and accomplishments of the children who did the best drawings. I was fortunate in that observations on these points were given to me by Mr J. Kilgour.

Brief notes have been prepared on the twelve children who obtained very high scores at the drawing test. It will be noted that only one (case 3) is outstanding in any other respect—such as scholastic, athletic or social achievements—which would bring him into the limelight.

Case 1. Drawing subjects, a soldier and a grotesque clergyman. Cheerful and an easy conversationalist. "Free and easy." Inclined to be lazy. Member of a large and happy family. A dreamer.

Case 2. Drawing subjects, a Spanish Dandy, and a formal subject of a man standing beside a chair. Moody and has to be coaxed. Nervous when faced with difficulties. Suspicious. Tendency to be dramatic. Likes reading adventure stories. (Two years later he was said to have undergone marked changes during adolescence and to be now very extraverted.)

Case 3. Drawing subjects, a Spaniard and a formal subject of a man smoking. "Good at everything." Shy and retiring. (Two years later, was said to be "coming out of his shell" and to be more sociable. An increasing tendency towards conceit and display was also noted.)

Case 4. Drawing subject, formal. Unfortunately little was remembered about this boy, as he left school shortly after the experiment began. His father is a ploughman. The boy is now working in a country weaving factory.

Case 5. Drawing subjects, formal. Timid. Confiding. Flustered at examinations. One of the few children who read newspapers regularly.

Case 6. Drawing subjects, formal. Reserved. Submissive. Lazy, but ambitious. Very keen on drawing, but not considered by his teachers to be particularly good at it.

Case 7. Drawing subjects, a sentry and a waiter. Markedly extraverted. Very talkative. Likes entertaining his friends at his home. Snobbish. Reads considerably.

Case 8. Drawing subjects, a soldier and a Scotsman. Deferential and insincere. Shifty. Avoids answering and would not look examiner in face. Cheats, in spite of being good at class work. Unhappy home life. The only boy to say that he likes writing letters.

Case 9. Drawing subjects, formal and a cowboy. Does not fit in with the other boys. Seemed conscious that his social standing was lower than that of his companions.

Case 10. Drawing subjects, formal. Very neat appearance. Well behaved. Conscientious. Unpractical, unlike an older brother, and seems to have an 'inferiority complex'.

Case 11. Drawing subjects, formal (hair very carefully drawn). Very quiet. Poor conversationalist. Plays by herself. Artistic.

Case 12. Drawing subject, formal. Shy and attractive. Left district after doing only two or three tests, including the drawing test.

These cases illustrate the point brought out by this experiment that young persons who draw men very well tend to have their thoughts turned out to the world of social realities rather than into themselves. The chief exceptions seem to be Case 11 (although the careful drawing of the hair may be highly significant of extraversion) and Case 10 (although the inferiority complex may point to an attempt being made to live in the world of realities). The same tendency is to be found when the children with drawing scores 15–13 are considered. The nineteen children with I.Q.'s over 114 may be taken as an example.

Case 13. Attractive. Polite. Submissive. Easily flurried. Unpractical.

Case 14. Self-reliant. Cheeky. Hasty in answering questions. Ambitious and pushing. Not scholastic.

Case 15. Shy. Unpractical. Does much reading but is very matter-of-fact and, for instance, despises poetry. Another of the few children who reads newspapers regularly.

Case 16. Very popular. Modest. Submissive. Easily flurried. Ambidextrous.

Case 17. Active. Frank. Talkative. Recommended to choose a sales career.

Case 18. Very cautious. Old for his years. Illness has interfered with his schooling. Enthusiastic reader. Wants to be a reporter.

Case 19. Cheerful. Active. Excitable. Wants to do the test better than anyone else.

Case 20. Jolly. Markedly linguistic. Level-headed. Wants to be a nurse.

Case 21. Active. Self-conscious. Old for age. Has had to care for mother who suffers from sleeping sickness.

Case 22. Highest intelligence of all girls. "Not too scholastic and quite practical." Individualistic and superior. Quite talkative after encouragement.

Case 23. Quiet. Shy. Dependable. Answers questions freely.

Case 24. Mercurial but "head screwed on all right". Assertive. Appearance rather unprepossessing. Few friends. A dreamer. Wants to be a missionary.

Case 25. Frail. Frequently kept from school by illness. Timid and too submissive.

Case 26. Very popular. Mother a widow and lives in straitened circumstances. Entertainer at parties. Appeared much more extraverted when doing tests than three years later when she was visited in connexion with 'follow-up'.

Case 27. Very shy. Too conscientious. Submissive but independent.

Case 28. Chatty. Delicate. Vain and given to display. Enthusiastic reader of newspapers.

Case 29. Bright. Clever at repartee. Extremely sociable—if playing leading part. Recites at concerts.

Case 30. Co-operative. Easily flurried. Likes a prominent place, but prefers not to be first.

Particularly interesting are seven cases of children whose I.Q. is under 85 who obtained a high drawing score (15–13).

Case 31. Very small physically. Regarded by teacher as a borderline case. Difficult in conversation.

Case 32. Repressed. Lame. Family name German, and this led to unpopularity during the last War. (Subjects of drawings: "A father about to punish his son for hitting a wee dog", and a very smart Scottish soldier.)

Case 33. Unstable and unreliable. Well meaning. Unhappy home life.

Case 34. Chatty. Particular about appearance. Excitable. Thought not to do himself justice at intelligence tests.

Case 35. Keen to get on. Comes from practical and unbookish family. Father often unemployed. Mother of the "anxious, talkative type".

Case 36. Spoiled. Only child. Unwilling to work. Wants to be a children's nurse.

Case 37. Frequently absent from school and exploited by parents who require her to do too much household work. Already reading novelettes.

One wonders what repressions and emotional conflicts led some of these Fife children to become skilled at drawing a man.

VII. Conclusion

There seem to be grounds here for evolving a theory that adolescents who draw men well tend to be of high (but perhaps not very high) intelligence, to be 'visiles' in their thinking, to be extraverted (and perhaps extremely extraverted), to be greatly interested in their fellow-men, but to prefer to mix with them and to influence their behaviour by indirect rather than by direct contacts. Support may be obtained for this theory by reference to the characters of illustrators, cartoonists and other black-and-white artists who specialize in drawing men. It will be found that, with astonishing frequency, their adolescence was difficult, both shyness and ambition being marked at that stage, and that as they grew older they appeared to become increasingly extraverted, perhaps to such an extent that they now seem to be highly extraverted.

It should be particularly noted that the theory is not that *all* persons who may be described in this way are good at drawing men.

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THE SUBJECTIVE JUDGEMENT OF THE ELASTIC AND PLASTIC PROPERTIES OF SOFT BODIES

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I. Introduction

In an earlier paper(1) it has been shown that the superiority claimed by certain craftsmen (skilled cheese manufacturers) in judging physical properties of soft materials by handling does not lie in any superior tactual acuity in distinguishing small differences in elasticity and viscosity, at least in the case of approximately solid substances like rubber and of very viscous liquids such as hard bitumens. That certain other factors, such as age, education and practice in routine testing, do influence the elastic and viscous 'thresholds' was also shown. It was further pointed out that two other factors would be of importance in

defining the capacity of an expert to give consistent judgements about the firmness of a set of samples; first, his capacity to recognize properties which he has previously learned to associate with desirable or undesirable qualities in his materials, and secondly, the degree to which he is able to reproduce the joint movements involved in performing the test by handling, especially with respect to constancy of the pressure applied and the time of its application.

Thus, in comparing the firmness of two materials differing in elasticity, since the viscosity of such materials depends on the stresses applied and the deformations produced, a decision of firmness will depend on the conditions of the test, and in the case of the comparison of the firmness of an approximately elastic rubber cylinder with that of a purely viscous bitumen, reversals of judgement can be obtained by varying the time during which the compression proceeds. This reversal was anticipated on purely physical grounds, since for a viscous material the amount of strain produced by a given stress increases proportionately with the time of application, whereas with an elastic material the strain reaches its equilibrium value almost instantaneously. The longer the stress is applied, the more the viscous material will have yielded by comparison with the elastic body, and the former will therefore be expected to be judged as relatively softer. On the other hand, it might well be that the comparisons are not in fact made in this way at all, and in order to test this a few quantitative experiments were carried out.

II. Preliminary experiments

(1) *Description of experiments*

Two of the best subjects from the earlier experiments were selected[1] ($m\Sigma\rho$ and $f\Sigma\rho$). Each subject was given a series of pairs of cylinders (diameter 2·0 cm., height 2·5 cm.). In the first experiment one member of the pair was a bitumen cylinder of viscosity[2] $10{\cdot}7 \times 10^6$ poises, and the other one of a number of rubber cylinders of which the compression

[1] The subjects were classified as follows (1):

m = male,
f = female,

age given in parenthesis.

Σ = scientific worker (σ was used in previous paper),
ϵ = university education,
τ = technologist (skilled cheese-maker),
ρ = routine analyst,
O = observer subject (vide p. 66).

[2] For explanation of this and other physical terms, see Appendix.

modulus varied from 0·78 to $1{\cdot}41 \times 10^7$ c.g.s. units. The subject was asked to squeeze the pair of cylinders on certain occasions with a 'high pressure' (P_H) and on other occasions with a 'low pressure' (P_L) for periods indicated by a metronome, short-time compressions (T_S) lasting for 0·5 sec., and long-time compressions (T_L) for 4 sec. The subject squeezed the samples twice, in time to the metronome, changed hands, squeezed twice again, and then gave a judgement for relative softness. The tests were done in a roughly thermostated water-bath at 20° C. P_H or P_L, T_S or T_L were taken in random order; and also the initial placing of rubber or bitumen in the right hand. Subject $f\Sigma\rho$, who is musical, was quite unworried by having to synchronize her movements with the metronome, whereas $m\Sigma\rho$, who is unmusical, at first found the procedure somewhat difficult. The latter subject, after a considerable number of experiments, commented on the difficulty of comparing such different materials as rubber and bitumen for softness, but both subjects were able to give judgements throughout.

In a second experiment, a standard rubber cylinder of compression modulus $1{\cdot}53 \times 10^7$ c.g.s. units was compared with bitumen cylinders varying in viscosity from 4·6 to $19{\cdot}8 \times 10^6$ poises.

(2) *Results of experiments*[1]

The results of these experiments are given in Table I.

It will be observed that, whereas for these materials the pressure exerted by the subject does not markedly affect the decision, the time

Table I

(*a*) *Constant bitumen*

Subject		T_L	T_S	P_L	P_H
$m\Sigma\rho$	B	30	3	18	15
	R	1	16	8	9
	I	1	13	6	8
$f\Sigma\rho$	B	31	9	20	20
	R	1	23	12	12
	I	0	0	0	0

(*b*) *Constant rubber*

$m\Sigma\rho$	B	25	7	16	16
	R	0	19	10	9
	I	7	6	6	7
$f\Sigma\rho$	B	24	15	18	21
	R	8	17	14	11
	I	0	0	0	0

B = number of tests in which bitumen was judged softer.
R = number of tests in which rubber was judged softer.
I = number of tests in which no distinction was made.

[1] Described in brief in *Nature* (1940), CXLV, 425.

taken has a very marked effect. In comparing bitumen cylinders with a rubber cylinder of constant modulus there is, in fact, a considerable range of viscosities over which a reversal of judgement can be induced by means of an eight-fold variation in time of compression. The same is true when the viscosity of the bitumen is constant and when the compression modulus of the rubber is variable. It might have been supposed that since differences in moduli of rubber cylinders could be detected with three times the accuracy possible for viscosities of truly fluid bitumen samples (see (1)) there would be a marked difference between the range of moduli over which reversal is induced in the constant viscosity experiment, and the viscous range in the constant modulus experiment. This is not so, probably because the advantage in judging elastic materials lies in the fact that they can be judged statically, whereas viscous materials must be judged dynamically; and in the experiments described above, since one of the samples was viscous in every test, this advantage could not occur.

In comparing the firmness of materials which in fact also differ in 'spring', two factors have to be considered. First, the method by which the materials are handled, producing different sensory reactions; and secondly, since 'firmness' in such materials has variable dimensions (i.e. those of viscosity in the extreme case of a true fluid and compression modulus in that of an elastic solid), a decision has to be made as to how to interpret these dimensionally variable stimuli in terms of 'firmness' in each individual case. It is not at present possible to differentiate completely between the effects of these two processes.

III. Experiment on the effects of training and experience on judgement

The preliminary experiments described above suggested that a much larger-scale experiment should be carried out to study the effects of training and experience in the capacity of individuals to give consistent judgements of comparative firmness or softness of materials varying in 'springiness' as well as in firmness. For this purpose twenty subjects were selected to compare the firmness of eight synthetic materials.

(1) *Method of experiment*

Seventeen of the subjects did the test 25 times, one subject 24 times, and one 26 times. Owing to the outbreak of war one other subject was unable to complete the experiments. Subjects were given the eight

samples and asked to place them on the bench in order of firmness, using any method preferred, except only that samples were not to be torn into pieces. After completing all the tests, subjects were asked for introspections as to methods of handling and a specimen test was done in which the method was carefully observed. In the experiments themselves subjects were not usually watched. The samples differed slightly in surface appearance, and in all tests, therefore, subjects wore dark glasses and worked in a poor light. Moreover, subjects were told that samples might change their appearance slightly from day to day as a result of handling. In a few cases, subjects were unable to distinguish pairs of samples, and these pairs were recorded as 'equal'.

A number of secondary factors, such as slight distracting influences in individual tests, differences in the temperature coefficients of the samples (taken as a group), alterations produced by over- or under-working, were recorded, but are not considered to have been of sufficient importance to be taken into account in the statistical analysis. Frequency curves were plotted showing the variation in the position allotted to all samples by all subjects for different temperatures. These showed only a very slight tendency for any sample to differ in temperature coefficient from the remainder.

(2) *Materials used in the tests*

As the technologist subjects were cheese-makers, it would have been ideal if we could have used cheese for the experiments. Unfortunately cheese changes its physical properties too rapidly, nor is it easy to obtain homogeneous samples of any size. For these and other reasons it was decided to make a material having viscous and elastic properties very similar to those of cheese, but this material was quite different in appearance and smell. These facts undoubtedly affected the technologists. However much the expert may be urged to base his judgements of cheese on the results of handling alone, he invariably finds great difficulty in keeping these judgements distinct from those derived from the other senses.

The samples were made by mixing rubber solution, vaseline and plasticine in varying proportions, and evaporating the solvent in the open air. Precautions were taken to ensure that the material should be as homogeneous as possible. The samples were made into cylinders weighing 222 g. each, height about 8 cm. and diameter 4·5 cm. These differed slightly in density and hence in volume. From time to time the samples were re-weighed, and, where necessary, made up to their original weights. Since the samples tended to become slightly firmer when left to stand, they were gently worked by hand each day before the beginning of the tests.

(3) *Experimental details*

No subject ever did more than one test per day, and after each test samples were roughly remade and left to recover for at least five minutes before further use. Samples were marked by inserting coloured drawing-pins one into each sample, the arrangement being changed each day. The two experimenters and one other subject (called O = 'observer subjects') knew the purpose of the experiment, were shown results as they accumulated and were able to follow their own progress. The experiment was not discussed with the remaining subjects until after all tests were completed. One of us (F.M.V.C.) handled the samples very frequently each day, the other (G.W.S.B.) less frequently. The third 'observer subject' had nothing to do with the experimental work.

(4) *Objective tests on the samples*

The aim of the experiments described in the present paper is concerned with the comparison of subjective judgements of firmness, and the relationship between these and objective data is at present only of secondary interest. It was not possible to cut up the samples during the experiment in order to make test-pieces suitable for objective measurements, but as soon as the main experiment had been completed, borings were taken from the samples and loading tests were done on an apparatus similar to that used for determining the compression modulus of rubber cylinders, described in the earlier paper(1).

Observation of the methods used by individual subjects, made on special tests after the main experiment was completed, made it possible to assess time (t) and pressure (p) scores for each subject. The t-scores (5, 4, 3, 2 and 1) corresponded respectively to quick jerky squeezing, rather quick squeezing, moderate, slow and very slow squeezing. Very few subjects continued a single squeeze for more than about two seconds. The pressure score corresponding to pressure exerted in squeezing was also assessed (p-score; 5 very hard, 4 hard, 3 moderate, 2 gentle and 1 very gentle).

In order to get objective data under comparative conditions, cylinders of standard size (2 cm. diameter and 2·5 cm. height) were loaded in the machine for 2 sec. and then released, deformations at the end of the loading period and after one minute's recovery being recorded. These experiments were done a short time after the completion of the main experiment. In order to get some measure of the extent to which the materials harden as a result of compression (strain-hardening), the loading

experiment was repeated, compressing for 10 sec. and measuring the total deformations produced after 2 and 10 sec. The ratio of the former to the latter gives a rough measure of strain-hardening, and the means of such ratios for duplicate tests are given in Table II.

Table II

Sample	1	2	3	4	5	6	7	8
Strain-hardening factor	0·76	0·77	0·78	0·90	0·72	0·95	0·90	0·81

It was not considered practicable to make a direct measure of the effect of increasing the load in decreasing the viscosity of the materials ('structural viscosity') but earlier experiments had shown that the addition of rubber to plasticine rapidly decreases both strain-hardening and 'structural viscosity'.[1] It therefore seemed probable that subjects who squeeze for a short period (high t-score), thus avoiding high strains and minimizing strain hardening, and also use a big force (high p-score), thus taking advantage of high 'structural viscosity', should tend to place 'dead' samples, such as 6, soft with respect to more rubbery samples such as 5, which show much less work-hardening, and probably less 'structural viscosity'. In Fig. 1 *a* (p. 68) are plotted the mean positions of sample 6 divided by those of sample 5 for each subject against $\sqrt{(t\text{-score} \times p\text{-score})}$. A correlation coefficient was calculated and is clearly significant (about 0·77, the significance being $P \simeq 0{\cdot}0005$). Although samples 6 and 3 do not differ as markedly as do 6 and 5, they are so similar in subjective firmness (the mean positional numbers for all subjects being 5·43 for 6 and 5·08 for 3) that it is of interest to give the scatter curve for this pair as well (Fig. 1 *b*). In this case the correlation coefficient was 0·73 with a significance of $P = 0{\cdot}001$.

It seems then, that in the case of a 'dead' sample such as 6, prolonged squeezing, instead of favouring a 'soft' judgement due to the continued flowing, favours a 'hard' judgement owing to the effects of strain hardening, and that the use of a big force, by reducing the viscosity, favours a 'soft' judgement.

To return to the first experiment in which cylinders were loaded for 2 sec. (see p. 66), the means of a number of replicates are given in Table III, the deformations being given directly in cm.

The mean positions for each sample, derived from the subjective

[1] These materials and many like them offer relatively less resistance to larger than to smaller loads, the phenomenon known as 'structural viscosity'. This is quite distinct from the hardening which takes place due to deformation and, in the case of compression, the two effects operate in opposite senses.

orders, are also given. It will be seen that some of the samples have changed their positions during the course of the experiment. A further analysis, not here described in detail, showed that there were slight aging effects in some samples. If these tendencies are roughly extrapolated to

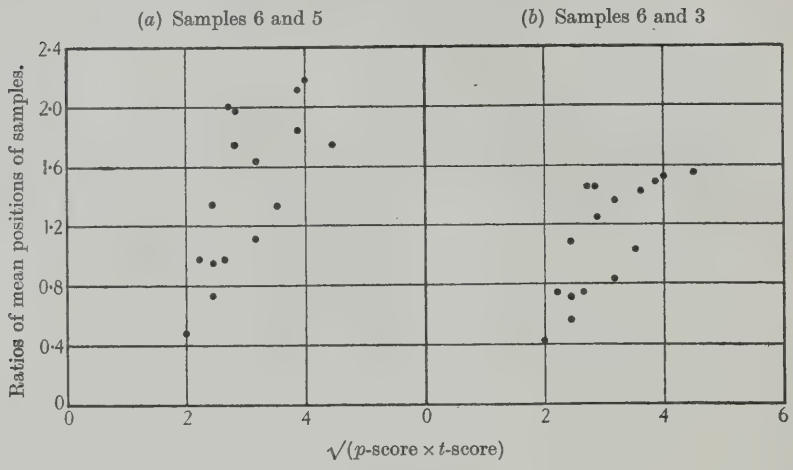

Fig. 1.

Table III

Objective data:	Sample no. 1	2	3	4	5	6	7	8
Total deformation after 2 sec. loading	0·262	0·283	0·443	0·324	0·449	0·406	0·929	0·580
Recovered deformation after 1 min. recovery	0·237	0·254	0·317	0·135	0·317	0·039	0·094	0·256
Non-recovered deformation	0·025	0·029	0·124	0·189	0·132	0·367	0·833	0·324
Mean 'subjective' position:								
First half of experiment	1·12	1·96	5·11	4·28	3·61	5·85	8·00	6·05
Second half of experiment	1·13	2·05	5·04	4·13	4·24	5·05	8·00	6·37
Extrapolated subjective position	1·14	2·14	4·96	3·99	4·89	4·29	8·00	6·67

the date at which the objective measurements were made, it appears that the mean subjective order agrees fairly well with the order of total deformations from Table IV, namely:

$$7 < 8 < 5 \leqq 3 < 6 < 4 < 2 < 1$$

(where $<$ indicates 'softer than').

IV. The treatment of the data obtained

A summary of all the data is given in Table IV, in which 'Mean position' indicates the average of the positions numbered from 1 (hardest) to 8 (softest) given by each subject on the twenty-five occasions on which the test was performed.

(1) *Statistical treatment*

The experimental data were divided into two parts, the 'first half' consisting of the first thirteen placings, and the 'second half' of the last twelve placings.

The variance of each sample for each subject was found for both halves, working about the means of each half of the experiment. Each of these variances was divided by the number of placings in that half-experiment and the square roots were taken. These figures are denoted by σ_1 and σ_2 respectively. Then σ_1 is taken as the index of self-consistency for the first half, and σ_2 as the index for the second half of the experiment. The learning factor, which is denoted by Λ, is defined as σ_1/σ_2. A complete analysis of variance, which would have been desirable, was ruled out because of the non-orthogonality of the factors. However, when the technologists, observers and certain other individuals were put on one side, we were left with a group of eight subjects in which sex was orthogonal to $\Sigma\rho$.

(2) *Analysis of variance for eight subjects in orthogonal classes*

With one exception, the analyses of the data for σ_1, σ_2 and Λ showed no significant main effects or interactions.[1] The exception was in the analysis for σ_2 where the $\Sigma\rho$ classification was significant at $P=0{\cdot}05$, the $\Sigma\rho$ subjects giving better self-consistency than the non-$\Sigma\rho$ subjects. It is noteworthy that the routine testers were in no case experienced in work

[1] Throughout this work, we have preferred to quote, for each conclusion, numerical values of P (the probability that a result at least as extreme as the observed result should have arisen by random sampling from a homogeneous population), rather than to use the conventional terminology whereby values of $P \leqslant 0{\cdot}05$ are baldly described as 'significant', all greater values being considered as 'non-significant'. While we realize the danger of any relaxation of the standard of confidence, we feel that in exploratory work of this kind, a level of P somewhat greater than 0·05 may give a valuable indication of the direction in which further investigations might profitably proceed. Further it must be emphasized that values of $P < 0{\cdot}05$ will not infrequently arise purely by the operation of chance. Any attempt to establish a sharp demarcation on the scale of P is quite unreal and frequently most misleading.

Table IV

Subject's category		Average time taken for test (min.)		Sample no. 1	2	3	4	5	6	7	8	Mean of σ's	Λ
fO	(26)	4·6	1st half Mean position	1·08	1·92	5·46	3·77	3·31	6·77	8·00	5·61	0·44	1·9
			1st half σ_1	0·266	0·266	0·634	0·422	0·605	0·576	0	0·738		
			2nd half Mean position	1·00	2·00	5·00	3·42	3·67	7·00	8·00	5·92	0·23	
			2nd half σ_2	0	0	0·408	0·494	0·623	0	0	0·277		
mO	(37)	1·7	1st half Mean position	1·00	2·00	5·00	4·00	3·39	6·76	8·00	5·69	0·46	1·0
			1st half σ_1	0	0	1·039	0·957	0·486	0·570	0	0·604		
			2nd half Mean position	1·17	1·83	4·50	5·00	3·17	7·00	8·00	5·33	0·45	
			2nd half σ_2	0·373	0·373	0·957	0·500	0·373	0	0	0·850		
mO	(25)	3·2	1st half Mean position	1·15	1·92	6·00	3·46	4·16	4·85	8·00	6·46	0·66	1·7
			1st half σ_1	0·362	0·474	1·109	0·746	0·890	1·166	0	0·499		
			2nd half Mean position	1·00	2·00	5·92	3·16	6·25	4·00	8·00	5·67	0·39	
			2nd half σ_2	0	0	0·492	0·550	1·235	0	0	0·847		
$f\epsilon\Sigma\tau$	(38)	1·5	1st half Mean position	1·31	2·00	6·07	4·08	4·23	4·46	8·00	5·85	0·92	1·4
			1st half σ_1	0·606	0·554	1·095	0·997	1·761	1·079	0	1·292		
			2nd half Mean position	1·08	2·66	6·17	4·17	5·42	2·42	8·00	6·08	0·65	
			2nd half σ_2	0·279	0·745	0·896	0·797	0·952	0·640	0	0·862		
$f\epsilon\Sigma\tau$	(39)	1·8	1st half Mean position	1·07	1·92	4·16	4·22	3·77	6·92	8·00	5·91	0·50	0·69
			1st half σ_1	0·266	0·266	0·883	0·972	0·697	0·266	0	0·614		
			2nd half Mean position	1·25	1·75	5·25	3·67	4·08	5·83	8·00	6·16	0·72	
			2nd half σ_2	0·432	0·432	1·165	0·745	1·045	1·400	0	0·539		
$f\epsilon\Sigma\tau$	(22)	1·5	1st half Mean position	1·15	1·84	3·92	5·00	3·31	6·92	8·00	5·84	0·43	0·61
			1st half σ_1	0·362	0·362	0·612	0·678	0·605	0·267	0	0·534		
			2nd half Mean position	1·17	1·83	4·17	4·83	3·92	5·58	8·00	6·50	0·70	
			2nd half σ_2	0·373	0·373	1·166	0·800	0·917	1·386	0	0·621		
$f\epsilon\Sigma\tau$	(36)	2·05	1st half Mean position	1·00	2·00	4·33	5·00	3·00	6·50	8·00	6·16	0·34	0·65
			1st half σ_1	0	0	0·473	0·707	0	0·957	0	0·554		
			2nd half Mean position	1·00	2·00	4·17	4·17	3·92	6·25	8·00	6·50	0·52	
			2nd half σ_2	0	0	0·800	0·800	0·968	1·105	0	0·500		
$f\epsilon\Sigma\tau$	(54)	1·9	1st half Mean position	1·15	2·31	6·00	4·08	4·69	2·85	8·00	6·93	0·50	0·73
			1st half σ_1	0·362	0·605	0·392	0·917	0·462	0·948	0	0·267		
			2nd half Mean position	1·50	3·00	5·17	3·84	5·58	2·00	8·00	6·84	0·68	
			2nd half σ_2	0·645	1·000	0·986	0·810	0·862	0·913	0	0·350		
$m\Sigma\rho$	(36)	3·2	1st half Mean position	1·08	1·92	6·15	3·38	4·37	4·84	8·00	6·23	0·62	1·2
			1st half σ_1	0·256	0·256	0·865	0·487	1·149	1·100	0	0·845		
			2nd half Mean position	1·08	2·00	6·16	3·33	4·93	3·92	8·00	6·57	0·53	
			2nd half σ_2	0·276	0·408	0·690	0·467	0·760	0·953	0	0·640		
$m\Sigma\rho$	(40)	1·0	1st half Mean position	1·08	2·31	4·69	4·76	3·61	5·15	8·00	6·37	0·88	1·83
			1st half σ_1	0·266	0·911	1·315	0·891	1·212	1·510	0	0·925		
			2nd half Mean position	1·00	2·25	5·41	5·13	3·92	3·25	8·00	7·00	0·48	
			2nd half σ_2	0	0·424	0·755	0·762	0·954	0·924	0	0		

Table IV (*continued*)

Subject's category		Average time taken for test (min.)			Sample no. 1	2	3	4	5	6	7	8	Mean of σ's	Λ
$f\Sigma\rho$	(18)	5·1	1st half	Mean position	1·07	1·92	4·84	4·53	3·00	7·00	8·00	5·61	0·32	1·3
				σ_1	0·266	0·266	0·769	0·635	0	0	0	0·626		
			2nd half	Mean position	1·00	2·00	4·92	3·50	3·67	7·00	8·00	5·91	0·25	
				σ_2	0	0	0·492	0·763	0·473	0	0	0·277		
$f\Sigma\rho$	(21)	5·3	1st half	Mean position	1·00	2·00	4·69	4·77	3·00	6·61	8·00	5·93	0·38	1·7
				σ_1	0	0	0·910	0·799	0	0·737	0	0·615		
			2nd half	Mean position	1·00	2·00	4·25	4·50	3·25	7·00	8·00	6·00	0·23	
				σ_2	0	0	0·595	0·646	0·595	0	0	0		
$m\epsilon\Sigma$	(36)	1·7	1st half	Mean position	1·23	1·77	5·15	3·93	3·77	6·15	8·00	6·00	0·71	1·3
				σ_1	0·421	0·421	1·025	0·730	0·887	1·405	0	0·774		
			2nd half	Mean position	1·08	1·92	5·58	3·33	4·50	4·83	8·00	6·75	0·57	
				σ_2	0·276	0·276	1·115	0·471	0·952	0·896	0	0·596		
f	(20)	2·8	1st half	Mean position	1·15	1·84	4·84	5·22	3·07	6·30	8·00	5·53	0·63	1·6
				σ_1	0·371	0·371	1·165	0·576	0·263	1·135	0	1·083		
			2nd half	Mean position	1·08	1·92	3·83	5·00	3·25	6·33	8·00	6·57	0·38	
				σ_2	0·279	0·279	0·533	0·407	0·433	0·622	0	0·493		
f	(35)	2·3	1st half	Mean position	1·38	2·00	5·31	4·15	3·77	4·76	8·00	6·61	0·96	0·94
				σ_1	0·837	0·554	1·265	1·230	0·890	1·671	0	1·239		
			2nd half	Mean position	1·54	2·46	5·30	4·22	4·46	3·23	7·92	6·84	1·02	
				σ_2	1·038	0·968	0·668	1·131	1·390	2·010	0·277	0·690		
m	(33)	2·3	1st half	Mean position	1·08	1·92	5·00	4·31	3·15	6·22	8·00	6·30	0·54	0·83
				σ_1	0·353	0·353	0·784	0·605	0·360	1·118	0	0·720		
			2nd half	Mean position	1·16	1·84	4·58	4·25	3·75	5·75	8·00	6·67	0·65	
				σ_2	0·373	0·373	0·953	1·091	0·923	1·091	0	0·471		
m	(46)	2·5	1st half	Mean position	1·15	1·92	4·46	4·84	3·77	5·92	8·00	5·92	0·81	1·2
				σ_1	0·368	0·475	1·284	0·934	0·800	1·638	0	0·994		
			2nd half	Mean position	1·08	2·00	5·17	4·33	4·08	4·50	8·00	6·83	0·70	
				σ_2	0·276	0·408	1·020	1·028	1·074	1·443	0	0·373		
$f\epsilon$	(36)	2·7	1st half	Mean position	1·23	1·77	5·00	4·00	3·31	6·69	8·00	5·82	0·56	1·1
				σ_1	0·421	0·421	0·775	0·957	0·450	0·604	0	0·860		
			2nd half	Mean position	1·33	1·67	4·17	4·25	3·50	6·75	8·00	6·17	0·50	
				σ_2	0·471	0·471	0·800	0·722	0·762	0·433	0	0·373		
$f\epsilon$	(41)	2·7	1st half	Mean position	1·00	2·00	5·77	3·69	3·92	5·46	8·00	6·16	0·45	1·5
				σ_1	0	0	0·422	0·462	0·915	1·691	0	0·949		
			2nd half	Mean position	1·00	2·00	6·00	3·67	5·17	3·38	8·00	6·83	0·30	
				σ_2	0	0	0·488	0·526	0·371	0·526	0	0·552		

of the type which was the subject of this experiment and yet that they were able to transfer in some measure an ability acquired in another field.

(3) *Analysis for classifications τ and O*

On making a t-test in which the data from the above eight subjects were compared with those from the five $f \epsilon \Sigma\tau$ subjects (i.e. all τ subjects), it was found that the $f \epsilon \Sigma\tau$ subjects were inferior in learning. The levels of significance for Λ, σ_1 and σ_2 were:

$$\begin{aligned} \text{For} \quad \Lambda \quad & P = 0{\cdot}02, \\ \sigma_1 \quad & P = 0{\cdot}4, \\ \sigma_2 \quad & P = 0{\cdot}4. \end{aligned}$$

These data present an apparent anomaly in that the σ_1 and σ_2 values show no significant effect whereas the Λ values, which are merely their ratio, show a markedly significant one. This anomaly arises from the fact that there is a very large dispersion in the initial values for all subjects, while the trend in the course of the experiment is predominantly towards poorer self-consistency for τ subjects and towards better self-consistency for non-τ subjects.

A 't' test was carried out between the f's and the m's, the O's being excluded from both categories. It was found that for σ_1, the women were more self-consistent, the probability being 0·1, while for σ_2 there was no appreciable difference.

Similar tests for O's and non-O's showed that while for the first half of the experiment the O's were superior, with a probability however of only about 0·4, in the second half, the O's were superior, with a probability of between 0·1 and 0·2. For Λ, the superiority of the O's had a probability of 0·1.

Similarly for the routine testers against the rest, for σ_1, there was no appreciable difference.

However, the superiority of the $\Sigma\rho$'s for σ_2 had a probability of between 0·05 and 0·1, while for Λ their superiority had a probability of between 0·1 and 0·2.

It would appear from the data in Table IV as if the younger subjects were superior in self-consistency and learning but, owing to non-orthogonality, no adequate statistical test of this is possible.

Standard deviations were then calculated as before, the experiment being divided into 'warm' and 'cool' halves. Of nine subjects who expressed a preference for testing on a warm day when the samples were softer, seven showed a better self-consistency at high temperatures as

against low; while, of four subjects who expressed a preference for a cool day, three had a slightly better self-consistency during the cool half of the experiment. The data on this point gave the value $P=0{\cdot}12$.

There was no correlation between the opinion expressed by the subjects as to the value of the experiment, and either σ_1, σ_2 or Λ, nor between these indices and methods of handling or age. The opinions expressed by subjects as to the probable value of these experiments are believed to be in no way correlated with the amount of trouble which the subjects took. As will be shown later, this latter factor probably has an important influence on self-consistency.

At certain stages in the experiment a subject would sometimes change drastically the position of a particular sample. A test was done to see whether there was any tendency for such changes to be slowed down as a result of a kind of mental inertia. An analysis of a completely random ordering of samples showed that, with the possible exception of sample 6, no such phenomenon occurred.

(4) *Mutual agreement of the subjective ranking orders*

In order to test whether the τ group showed superior mutual agreement as a group over other categories of subject, the standard deviations were taken for the mean positions of each sample for the whole of the τ group and compared with those for all other subjects (excluding O subjects) taken as a group. The results taken as a mean for all samples are given in Table V.

Table V

	First half	Second half
Mean deviation for non-τ group	1·28	3·21
Mean deviation for τ group	3·92	4·62
Significance level, P	0·02	0·15

This shows that, especially in the first half of the experiment, the technologists showed very definitely less agreement among themselves than did other subjects.

Moreover, in both classes the agreement becomes less close as the experiment proceeds, which is contrary to expectation, and the τ subjects at the start are already showing a more marked individuality than do the remainder at the end of the experiment. It appears, therefore, that the closest agreement in subjective ranking order is found in a group of subjects having no previous experience of this type of task. With progressive experience, the individuals of a group appear to develop more

individuality of judgement of firmness of materials when variations in springiness must be taken into account.

The results of the statistical analysis other than those given in Table V may be summarized as shown in Table VI.

Table VI

Groups being compared				Mean for group	Mean for group		
	(*a*)	(*b*)	Criteria	(*a*)	(*b*)	*P*	Remarks
8 orthogonals	$\Sigma\rho$	Non-$\Sigma\rho$	Λ	—	—	$\geqslant 0{\cdot}05$	
			σ_1	—	—	$\geqslant 0{\cdot}05$	
			σ_2	—	—	$0{\cdot}05$	
	Interaction of sex on $\Sigma\rho$		σ_1	—	—	$>0{\cdot}05$	$f\Sigma\rho$'s more self-consistent
	τ	8 orthogonals	Λ	0·82	1·31	0·02	
			σ_1	0·54	0·64	0·4	
			σ_2	0·65	0·54	0·4	
	τ	Rest excluding *O*'s	σ_1	0·54	0·62	0·5	
			σ_2	0·65	0·51	0·25	
	τ	f and $f\Sigma\rho$	Λ	0·82	1·36	Nearly 0·05	
	f	m	σ_1	0·54	0·71	0·1	*O*'s excluded
			σ_2	0·55	0·58	0·8	
	Σ	Rest excluding *O*'s	σ_1	0·52	0·60	0·45	
			σ_2	0·36	0·56	0·15	
			Λ	1·56	1·15	0·1	
	ρ	All others	σ_1	0·55	0·59	0·7	*O*'s excluded
			σ_2	0·37	0·57	0·07	
			Λ	1·49	1·14	0·15	

V. Discussion

The importance of the problem of expert superiority has long been realized. McDougall ((2), p. 245) writes: "As all the world knows, since Plato and Herbart, each subject perceives only what he is capable of perceiving, only what he is prepared by nature and by experience to perceive. We may fairly assume that, in any two normally constituted persons, the sensory effects of similar sense stimulations, the sensory qualities experienced, are alike; yet, as we know, they may perceive, in response to similar sensory stimulations, very different objects, or perceive the object with very different degrees of adequacy. In every field the expert perceives far more than the inexpert; because he reacts upon similar sense impressions with a more adequately prepared mind. In some senses, the stored traces of his many experiences in his special field of observation rise up to meet the sense-impressions and to mould them in conformity with those past experiences."

To-day we are perhaps less confident that the sensory qualities of normally constituted persons are so much alike, since we have, in fact,

no way of knowing. It has been proved that certain types of experience, e.g. routine work of a kind quite unlike the task presented, make it possible for subjects to acquire a superior capacity for distinguishing materials showing simple physical characteristics, such as viscosity and elasticity, when these properties differ by small amounts in the materials judged (1). The effective experience may have no direct connexion with judging materials by handling, but may involve rather the development of a particular type of mental attitude, such as that induced by long practice in routine analytical operations. Routine workers such as analysts are less likely than most other subjects either to allow themselves to be affected by boredom, or by doubts as to the value of the tests they are asked to do.

In such cases at least, there is no reason to suppose that the sensory qualities experienced in handling materials are in any way modified. Trained technologists who might be expected to possess in a special degree traces of previous experience which would be advantageous in such experiments, are, in the long run, in no way superior in self-consistency to the ordinary subject, but rather the reverse. In the earlier stages of the experiment, the technologist appears to be superior, although the significance level is only $P=0{\cdot}4$, but in general such subjects do not improve, so that, taking the experiment as a whole, the group is slightly inferior. (Significance level $P=0{\cdot}3$.) This is surprising, since one would expect from purely physical considerations that a capacity to reproduce joint movements both with respect to their extensive and intensive factors (i.e. both for strain and stress) with superior accuracy, must yield more consistent sensory stimulations likely to lead to a superior consistency of judgement. That experts in other fields can reproduce their movements more perfectly than inexperts seems fairly certain; this is, for example, convincingly shown by the ability of figure skaters to reproduce curves cut on the ice, which forms a fair criterion of the skill of the skater. That the superiority of such experts is not limited precisely to those movements which they have already learned, but can be carried over to new but similar movements, is shown by the fact that experts learn new figures more quickly, and even at the first attempt give a better performance than do inexperts.

Head has proposed (3) a theory which postulates the existence of 'schemata' which "modify the impression produced by incoming sensory impulses in such a way that the final sensations of position or of locality rise into consciousness charged with a relation to something that has gone before"; and Bartlett (4) has extended this theory very considerably.

At first sight it would appear that Head's theory should lead us to expect an almost automatic series of responses for a given series of stimuli, but Bartlett points out that "man must learn how to resolve the 'scheme' into elements, and how to transcend the original order of occurrence of these elements. This he does, for he learns how to utilize the constituents of his own 'schemes' instead of being determined to action by the 'schemes' themselves, functioning as unbroken units".

As mentioned in the earlier paper (1), Prof. Bartlett suggested to us that the theory of schemata might well be applicable to our problem. One would certainly expect the technologists to acquire "some kind of functional standard which they can use, not in any such specific form that is recognized or remembered, but in very much the same manner as Head supposed his postural schemata to work".[1]

The experiments described in the present paper were done on materials physically (i.e. rheologically) similar to cheese, but our cheese-maker subjects, with one exception, emphasized to us the dissimilarities rather than the similarities and, after the test, expressed the general opinion that their technological experience could not be expected to have helped them in the experiment. These subjects did not improve in self-consistency during the course of the experiments, as did most of the other subjects, and, except possibly in the first half of the experiment taken alone, were not superior, as a group, in self-consistency. The exception was a cheese-maker subject who, expecting that her technological experience would be advantageous, although being very modest as to her own powers of testing, improved appreciably during the course of the experiment. Two of the best-known cheese-graders in the South of England performed the test once and three times respectively. The agreement between these two subjects was poor, the self-consistency of the latter was apparently below average, and the former placed sample 7 as firmer than sample 8, a judgement only once given in the course of our 475 regular tests, and that by one of the least self-consistent subjects.

We must conclude that any advantage that these technologists may have had as a result of their experiences in testing materials very similar but not identical with those used in this experiment, did not produce any superior self-consistency which could be maintained during a longish series of tests. Although there is no quantitative evidence, it is our opinion that this is due primarily to mental attitude. Such subjects are used to certain conditions when they test materials. First, their opinion is generally accepted almost without question; secondly, every

[1] Prof. Bartlett, private communication.

single judgement given is for immediate practical use; and thirdly, there is no doubt that properties judged by handling by these technologists are seldom assessed without confusion with appearance and smell, in which our materials could not aid their judgements. In the earlier stages of the experiment, the novelty of the tests combined with a comparatively open mind as to their usefulness, probably helped to give good results, whereas later, the apparent purposelessness of a daily test on the same materials caused a deterioration of self-consistency. This was perhaps increased by a natural distaste, not fully shared by other subjects, for activities which must have seemed to the technologists to have been copied, and badly copied at that, from their usual purposeful activities.

This inflexibility of technologists, although disadvantageous to rapid adaptation, is doubtless important in giving self-confidence, and also in helping them quickly to identify and discard any material unlike that usually met with, which is perhaps useful in establishing the technologists' standard on which industry still places so much reliance.

VI. Summary

1. Experiments are described on the self-consistency and its improvement with practice, of various types of person in reproducing judgements of the comparative 'firmness' of materials which differ in both elastic and plastic properties.

2. In the case of such materials, technologists who are used to comparing the 'firmness' of similar substances show little superiority over other subjects in earlier tests, and are somewhat inferior after the test has been repeated a number of times. The reasons for this, which are believed to depend largely on mental attitude, are discussed. The technologists agree among themselves definitely less closely than do the other subjects. Moreover, with the progress of the experiment, both technologists and others tend to disagree more and more.

3. Routine analysts, hitherto quite inexperienced in this type of testing, showed a marked superiority over other subjects, including the technologists. This again points to mental attitude as preponderant in tests of this kind.

4. Scientific training and sex show comparatively little effect on self-consistency or learning capacity. Knowledge of the progress of the experiment was slightly advantageous.

5. There is a marked correlation between the force and speed of handling and the relative positions given to 'elastic' and 'dead' materials

in placing them in order of 'firmness'. The importance of the reproducibility of stresses and times in making such judgements by handling materials is discussed, and it is shown that an eight-fold difference in time of handling gave a reversal of 'firmness' judgement in comparing an elastic body of constant compression modulus with viscous bodies whose viscosities varied over a considerable range. This effect is also present when a body of constant viscosity is compared with a series of elastic bodies of varying compression modulus.

6. The mean subjective order for eight samples in the 475 tests performed by nineteen subjects agreed closely with the objective measurements of total compression, elastic and plastic, produced under standardized loading conditions.

The authors wish to thank Dr P. White who is responsible for the statistical treatment of the data, and Mr F. Johnson Dix who has carried out many of the computations, as well as the twenty subjects whose patient co-operation has made this research possible.

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APPENDIX

Note on physical terms used in this paper

It has been impossible to avoid using certain technical physical terms in the presentation of this paper, although such use has been reduced to a minimum. For the benefit of those unfamiliar with these expressions, the following short notes are appended:

Stress represents the force exerted on each square-centimetre of the material. (Dimensions $\frac{\text{force}}{\text{area}} = \text{mass} \times \text{length}^{-1} \times \text{time}^{-2}$.)

Strain (in compression) is the amount of deformation produced, expressed (at least for small strains) as a proportion of the original height of the sample, and is thus dimensionless.

A true fluid is a material whose rate of flow is proportional to the stress causing the flow, i.e. a material which shows some flow, however small the stress applied. The constant of proportionality is called *viscosity*. In cases where viscosity is not independent of stress (not true fluids) it is frequently quoted for a standard condition of stress. (Viscosity has dimensions $\text{mass} \times \text{length}^{-1} \times \text{time}^{-1}$.)

An elastic solid shows an immediate deformation ('strain') proportional to the load applied to it, and this deformation is recovered when the load is removed. In many materials (not truly elastic solids) the recovery is neither complete nor immediate. The ratio of the stress applied to compress the solid to the strain produced is called the *compression modulus*. The modulus, being a stress divided by strain, has the same dimensions as stress, i.e. mass $\times$ length^{-1} $\times$ time^{-2}.

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THE PSYCHOLOGY OF THE HISTORY AND ORGANIZATION OF ASSOCIATION FOOTBALL[1]

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PART I[2]

I. *Introduction* (pp. 80–81).
II. *Medieval and early football* (pp. 82–84).
III. *The Football Association* (pp. 84–87).
IV. *The International Board* (pp. 88–90).
V. *The F.I.F.A.* (pp. 90–93).

I. Introduction

Football and cricket are strikingly social games. Tennis can be aggressive and individualistic; golf can be particularly aggressive, and, if there is no better rival, it can always be a lonely game in which one plays against Bogie. The individual gifted football player has never been able to draw crowds by his own personal prowess alone, without ten players to support him and eleven to play against, and some footballers have found this out to their cost. The public does not go to see particular teams doing acrobatics with a ball. They go to see the match, though some may support one side and some the other. Unless a given player could play with a team approximately his equals, and that team against another team matched well with it, there would be little or no interest in organized football as we know the game. The individual player who has private fantasies of self-importance cannot afford to detach himself from his club, or that club from its League and Association connexions,

[1] I should like to express my warm appreciation of the kindness which has always been extended to me by members of The Football Association Council and of the International Football Association Board, but they are in no way responsible for any ideas expressed in this paper. I am specially indebted to my father, the late W. Pickford, who was President of The Football Association, for his help with the historical part. I am also indebted to my wife for her constructive criticisms, and to Profs. F. C. Bartlett and M. Ginsberg and to Dr J. T. MacCurdy for their encouragement. This paper was written for a group of Social Psychologists who met at Bellingham in June 1939, and it was read to them and also to the Scottish Branch of the British Psychological Society in December 1938.

[2] The references included in Part I of this paper will be listed at the end of Part II.

because the whole interest of the game lies in the organization of matches and competitions, and without that organization its tremendous public interest would rapidly dwindle and vanish.

We might almost say that the object of play is to have a good game and not even primarily to win the match. Competition is an essential part of such a match, but a good game is not to be got merely by battering an opponent, and therefore a new kind of interest develops under these conditions. It is the interest of constructive social activity in which fair play controls the proceedings.[1] This means that the game is conducted in such a way that everybody gets something and nobody gets everything, and, from the point of view of social psychology, essentially the something which everybody gets is the comradeship of everybody else (cf. Suttie (22)). The great interest of games like cricket and football is due to their capacity to foster comradeship by combining team work with a form of competition which has lost its destructive and hurtful qualities (cf. Rimet (19)). The rules and laws of these games were not invented by some expert who sat in a chair and evolved the rational football or cricket according to logical principles; on the contrary, they were formulated in response to the actual problems of play, and are the concrete expression of the deep-seated desire for harmonious games.

Certain data about the history and expansion of association football have been chosen in order to illustrate how traditions of co-operative enterprise have been built up in the development of regularized football, with the limitation of individual mastery and acquisitiveness. It seems to be the most essential point in the development of regularized football, that co-operative enterprise in a social activity in which so much aggression and so many ideas about individual and group conflict are involved, would not have been possible apart from the fundamental importance of fair play in group games. Since possibilities of conflict and aggression are also involved in almost all human co-operative activities, the history of football is of some psychological value in relation to problems of group organization in general. The historical data are interesting in connexion with the problem of avoiding threats of international aggression, and they also show how association football has spread widely with an amount of change unusually small in the transmission of a branch of ceremonial culture.

[1] The writer hopes to discuss the psychology of fair play and some other aspects of games and sports in a later paper. Compare the 'fair play' in games with the 'art work' in pictures (24), and with *morale* in other situations (18). Football often seems like a form of territorial combat, which is common in the animal kingdom (1).

II. Medieval and early football

Games of football have been a form of ceremonial culture since ancient times, and they have been widespread in one form or another in many parts of the world. There is evidence that football was played in China in the third century B.C., with a round ball stuffed with hair. An air-filled ball was introduced in the fifth century A.D. (9). An interesting game called *Kemari* has been played in Japan for about fourteen centuries (23). The ground was about fourteen metres square. There was a pine tree at the north-west corner, a willow at the south-east, a cherry tree at the north-east and a maple at the south-west. There were usually eight players, and the match was a ceremonial kicking of the ball from one to another—it was not a competitive game according to our ideas of football. It seems unlikely that the British medieval games of football were descended from the Roman game of *harpastum*, though it may have influenced them; the Greek game of *episkyros* seems to be more closely allied to modern football (9). There is evidence that games of football have been widespread among many different tribes and peoples (7, 15).

The medieval Florentine game of *calcio* still survives (13, 25). It is played in the *Piazza della Signoria* in Florence, twice a year, on the first Sunday in May and on 24 June, the Feast of St John Baptist, the patron saint of Florence. There was a memorable game in 1530, when the Florentine nobility played *calcio* under fire of the Imperial troops besieging the city. It is the occasion of a pageant with revival of sixteenth-century dress and armour, and a feature of the celebrations is the procession before the game. The day of the game is a public holiday and shops are closed. The two sides are called *bianchi* (whites) and *rossi* (reds), and each team consists of twenty-one players of whom eleven are forwards and the remainder defend the goal, which extends the whole width of the 'field'. The *Piazza* is covered with a layer of sand for the occasion.

The games of football played in medieval Britain seem to have been very violent and usually to have involved many if not most of the able-bodied inhabitants of a village or district, and many attempts were made to put them down by law.[1] In 1314 there was a proclamation by Edward II which prohibited the hustlings over large balls (*ragaries de grosses pelotes*), and in 1349 a game designated in the statute by its present name was objected to by Edward III. Similar attempts were

[1] Gibson and Pickford (10), Jackson (11) and Shearman and Vincent (21) have been the chief sources of data about the game up to about 1900, except where otherwise stated. The *F.A. Handbook* (20) and the *F.I.F.A. Handbook* (8) have been useful throughout.

made to suppress football by Richard II, Henry IV, Henry VIII and Elizabeth. It is of great interest that the most serious objection to football in these times was that it drew young men away from the 'manly' occupations of learning archery and the arts of warfare. The importance of this will be seen later. In the seventeenth century football declined in popularity, but was kept alive by the younger generation and ultimately became a regular part of public school life, and developed again in the athletic revival of the nineteenth century.

It is important to stress the violent and uncontrolled nature of the medieval games. When football was to be played, as it was often in the streets, shopkeepers put up their shutters, and sometimes during the game many people received serious injuries. By the beginning of the nineteenth century it seems to have become more restrained; fewer players took part and definite goals, two or three feet wide, were used. Shrove Tuesday was often the ceremonial occasion for games of football, and there have been survivals of this through the nineteenth century. At Corfe Castle the game was the annual celebration of the charter granted to the 'marblers' of Purbeck by Queen Anne, whereby the 'free' men of the stone trade were allowed on certain conditions to open quarries and dispatch stone by sea. The game recorded in the year 1902 was an initiation ceremony by which fourteen lads were made 'free'. At Scone the Shrovetide game of football was a combat between the bachelors and the married men; in Midlothian and at Inverness it was between the married and single women. The ball was probably identified symbolically with the pancake of Shrove Tuesday. An interesting game is recorded(10) for which a 'pancake football' was made out of bottle-corks enclosed in a large bag. The ball was broken in the fight and each cork gained was the token for a gill of ale. The game was played in northern villages. The game called 'hurling' was often between rival villages, parishes or towns.

These games, differing from place to place in motive, purpose and manner of play, and in other details, were adopted by the English public schools or transmitted to them, and most of these schools had developed their own peculiar forms of football by the beginning of last century. In these schools the games became traditional and stabilized, and, though still violent, tended to become simpler and more definitely organized with accepted laws of play. Different traditions developed, however, and it is interesting to note that Eton was unfavourable towards handling the ball, while at Rugby handling was accepted, and, though at Rugby 'hacking' above the knee was in general 'unfair', a

player who had the ball when he was in a maul and refused to put it down might be hacked legitimately. The games differed much from school to school, and it would have been difficult for matches between different schools to have taken place, but on the whole football became refined and whittled down towards its present form. It became less violent and smaller numbers of players took part; sides were of equal numbers; it was played on fields or grounds of recognized and limited extent and with standardized goals. Certain essential laws of play became established and have led to the present principles of throwing-in, off-side, handling (as in rugby) or not handling, and to the very reasonable objections to kicking, holding down, throttling or otherwise hurting an opponent. Ordering a player off the ground for misconduct seems to have begun at Harrow. The distinction between 'ups' and 'behinds' at Winchester seems to have forecast the present arrangement of forwards, half-backs and backs. 'Umpires' were posted at the goals in the Eton game. At Cheltenham the referee seems first to have appeared. He was chosen by the umpires, but these umpires themselves eventually became the linesmen of the modern game.

III. The Football Association

The essential motivation for the next step in the development of a football game played according to widely accepted laws or rules of play was due to the collection of boys from various public schools as undergraduates at Cambridge University. They wished to form teams and to play football, but did not all follow the same laws of play because they did not all come from the same school. There is a lack of detailed records, but the difficulty due to the variety of public school games must have been an obstacle to undergraduate play, and the desire for this play was sufficient to motivate efforts to come to some kind of understanding. The result of these efforts was the formulation of the 'Cambridge Rules'. An attempt to form a football club at Cambridge University, made by H. de Winton and J. C. Thring, in 1846, was not very successful, and about 1848 a serious attempt was made to formulate a set of laws under which men from different schools could play together. At a meeting held in H. C. Malden's rooms in Trinity College, Cambridge, Harrow, Rugby, Winchester and Shrewsbury were represented, and, between 4.0 p.m. and midnight, the 'Cambridge Rules' were compiled by voting on all the various school rules brought to the meeting by the different school representatives. They consisted of the most harmonious combination of the different school rules which could be made. Copies were

printed and distributed, and posted up on Parker's Piece, where many of the matches were played at the time, and these rules appear to have satisfied everybody and worked well. J. C. Thring took essentially the same set of rules to Uppingham School, where he subsequently became a master, and he called them 'The Simplest Game', in 1862, and the text of these rules is still in existence. It is not important to quote the ten rules of the 'Simplest Game' here, but it is interesting that handling the ball was restricted very much, and kicks were to be aimed 'only at the ball', while tripping or heel kicking an opponent was prohibited.

Between 1846 and 1863 several attempts had probably been made to formulate rules which could be applied widely, because clubs were springing up in many places. The Sheffield Club was formed in 1855 and old Harrovians took to playing in Epping Forest about 1859, which was the origin of the Forest Football Club which later became the Wanderers. In October 1863 another committee of Cambridge men, representing Shrewsbury, Eton, Rugby, Marlborough, Harrow, and Westminster, undertook to formulate a new and better set of rules, 'The Cambridge University Football Rules'. These were more elaborate but essentially the same as those of the 'Simplest Game', and again handling was restricted and pushing, shinning, and tripping were forbidden, but charging was allowed. The size of the ground and goals and other conditions of play were fixed definitely.

At this time the centre of activity changed to London, probably because graduates who had gone down from the universities and non-university men became interested in the new and regularized kind of football. In October 1863 a meeting was held at the Freemason's Tavern, London, and the chief clubs were represented. It was decided to form 'The Football Association'. There was some difficulty in getting the public schools to agree to join this Association because they were unwilling to give up their own particular games, and at the next meeting, in November 1863, there were heated discussions about 'hacking', 'tripping' and 'holding'. On 1 December the Blackheath Club, which had been formed in 1858 to promote the 'carrying' game, definitely withdrew. Its members were unwilling to give up hacking. Other clubs of the same opinion also withdrew. It is interesting that this was the beginning of the history of the rugby as distinct from the association game, though later the Rugby Union gave up hacking. Handling, together with the shape of the ball and number of players, are the most important distinctions of rugby as contrasted with association football.

At first the Sheffield clubs did not play strictly according to the

London Association Laws, but in 1867 and the next few years their rules were brought into line with those of the London game. The long series of matches between London and Sheffield began in 1871, and in the same season The Football Association Challenge Cup was started. In the season 1870–1 two matches had been played between England and Scotland, but these do not rank as international matches because the Scottish teams were chosen from among Scots resident in England.

It is not possible to follow in detail the very interesting history of the expansion of The Football Association. At first it was largely concerned with amateur football, with the popularization of the game and the establishment of good standards of sportsmanship for football. Later on it became essential in the interests of the game to deal with the problems of professionalism, and now The Football Association has taken over the control and legislation for professional football in addition to the support and encouragement of amateur players. The Association owes its power and authority to the desire of innumerable clubs and its many component associations, both amateur and professional, to co-operate in arranging competitions, in playing matches and in all the aspects of the immense organization of association football to-day. This is an entirely democratic arrangement. The essential compulsion which makes clubs and associations join The Football Association, play according to its laws and abide by its rules and jurisdiction, is their need for adequate opportunities for play against other good teams. There is no reason why a club or association should not be formed independently, and some independent clubs do exist. For instance, there is an organization which supports Sunday football and arranges competitions on a league basis, though The Football Association prohibits Sunday football for its own members. The scope of the Sunday organization is limited, but its clubs adopt the accepted laws of the association game. There is no reason why an independent club should not make its own laws, but the difficulty of arranging a satisfactory season's programme would be so great for such a club that it would soon find itself under serious handicaps unless it joined the Association.

The Football Association has striven successfully to prevent, as far as possible, private gain as an incentive to the organization of clubs and matches. A restriction has been imposed which limits the amount of interest payable on money lent to clubs in England to $7\frac{1}{2}\%$ in any one season. Promoters of scratch teams, which might be used for money-making purposes, must obtain permission from the Association to take part in matches unless no gate-money is taken. The authority of the

Association lies in its value to the players, clubs and component associations in organizing the game for their advantage.

It is of special interest that a major split in The Football Association was avoided owing to the capacity of the Association for compromise over professionalism, to which it was originally antagonistic. Secret and even open professionalism and the importation of players, largely from Scotland, who were paid indirectly in one way or another, had grown so much in the north of England, that special efforts to prevent these practices were made between 1882 and 1884. The interest in professionalism, however, became so strong that, in October 1884, some leading Lancashire clubs held a meeting at which it was decided to form a 'British Football Association' which would admit professionalism. The result of this was the appointment of a special committee of The Football Association, which met in Manchester in November 1884 and recommended the legalization of professionalism under strict conditions. After further conflict and opposition, professionalism was duly legalized by the Association in July 1885.

A similar example of the elasticity and spirit of compromise which have always been leading principles in the organization of the game was shown in the relations between the Association and the Amateur Football Alliance. A number of amateur clubs, dissatisfied with being linked through the Association with professional football, seceded in 1907 from The Football Association. After forming the Amateur Football Association and running this organization for several years they failed to attract the mass of amateurs, who were contented to remain in The Football Association. In 1913 the Football Association agreed to recognize the Amateur Association as one of its affiliated bodies, with representation on the Council and a limitation of the number of its clubs to 400. Later its name was changed to the Amateur Football Alliance to distinguish it from The Football Association.

In 1903 The Football Association became a Limited Liability Company with a nominal capital of £100, divided into 2000 shares of 1*s.* each. No shareholder is allowed to draw any dividend upon his holding, and the Company exists for the purpose of supporting and advancing the interests of the game, and not for obtaining or holding control or mastery for its own sake or for money-making. The main part of the takings at association football matches goes towards the expansion and development of the game and not into private pockets.

IV. The International Board[1]

In Scotland the ancient game of football seems to have died out about 1820, but the association game was started in Glasgow by the Y.M.C.A., whose members often met to play friendly matches at Queen's Park. In 1867 they formed the Queen's Park Club, and adopted the association rules with some modifications. After this association football spread rapidly in Scotland, and in 1870 the Queen's Park Club joined The Football Association. They were not contented without national independence, and the Scottish Football Association was established in 1873, by a meeting convened by the Queen's Park Club. Eight clubs were in the original Scottish Association, and a cup was bought for £50 to be the trophy in the annual competition which was then started. The Scottish Association was remarkably successful, and adopted from the first a highly independent attitude. The Scots had no intention of allowing the English complete and undisputed authority. The Scottish Association claimed the right to construe the laws as it thought fit, and there were considerable difficulties over interpretations of rules and methods of play in the international matches. These difficulties were not satisfactorily overcome until the establishment of the International Football Association Board in 1885.

As a result of the introduction of the game to Ireland in 1877 by the influence of the Scottish Football Association, the Irish Association was formed in 1880, and soon established its own cup competition and arranged international matches with England, Wales and Scotland. The game was taken up chiefly in Belfast at the beginning and somewhat later spread to Dublin and the south. The Welsh Association was formed at a meeting in Shrewsbury in May 1876, as a result of an international match with Scotland, and so the Scots were largely responsible for the spread of association football both to Wales and to Ireland. In 1877 the Welsh Association Challenge Cup was instituted; in 1879 international matches were begun with England, and in 1882 with Ireland.

There were various points of difference between the Scottish, Irish and Welsh Associations and the Football Association, and, in 1885, at the proposal of the English, an International Football Association Board was established. All differences of opinion were to be referred to the Board, and its decision became necessary for alterations to the Laws of the Game. It was to consist of two representatives from each of the four

[1] Data about the International Board were obtained from Gibson and Pickford(10) and from Pickford(16).

nations concerned, and this is interesting, because, although these four nations are very unequal in size and wealth, and one of them, namely, England, had a strong claim to be considered the originator of the game, all four have equal voting powers on the Board. This is an important aspect of the conciliatory way in which international football is conducted, and it is perhaps characteristic of England that the proposal to form the Board came from her Association. The separate national associations play by the same Laws of the Game, are independent as far as the affairs of their own countries are concerned, but meet on equal terms to decide questions of importance about international matters. The formation of the International Board was comparable, in some ways, with the original construction of the Cambridge Rules, whereby the various public school representatives met on equal terms to form a game which they could all play at the University.

In addition to the two representatives each from England, Scotland, Ireland and Wales, two representatives of the International Federation are also members of the Board. These men from the Continent will be mentioned again later. The secretaries and treasurers of the different national associations also attend the Board meetings, and occasionally other members of the associations, but without voting power. The Board meets once a year, in each of the four British countries and on the Continent, in rotation. After a meeting the minute book is sent to the secretary of the Association in whose country the next meeting will be held. The arrangements for this meeting are in his hands, and his Association will entertain the Board. The pairs of representatives are chosen by their own associations and they are usually senior members. At a given meeting a representative of the country in which it is held, usually the senior representative, presides over the Board meeting, and so both the chairman and the secretary of the Board change year by year. The meetings are very friendly, and from the beginning much has been made of their social side. These social aspects were possible partly because of the small number present, the interest created by the variety of nationalities and the spirit of friendly rivalry between them, but largely because of the comradeliness of the members themselves. Nevertheless, members are downright and outspoken—forthright, as the Scots like to say—when matters of national importance are discussed, so that the meetings are friendly though not always tranquil. In this manner the Board has conducted the international business of English, Scottish, Irish and Welsh Association Football in a harmonious and constructive way for over fifty years, and warmth of national feeling has not been, and is not

likely to be, an obstacle to it. The advent of the Continental members in 1924 has made its meetings even more interesting. Their presence will be explained later.

Primarily the International Board exists to control the Laws of the Game, that is to say, the code which applies to the actual play of the game itself all over the world. The members of the Board also come to certain agreements which do not amount to alterations or additions to these laws. For example, "An International Match shall not commence later than 3.30 p.m. except by the mutual consent of the Associations concerned"; or "In International matches the jerseys worn by both goalkeepers shall be of the same colour—deep yellow"; or "A professional who has been reinstated as an amateur shall not be eligible to play in Amateur International matches". These agreements are necessary in order that the different national bodies shall not unintentionally fall foul of each other's private arrangements, such as rules dealing with problems of professional and amateur status, dates of closed seasons, and so on, which are important, but do not directly affect the actual Laws of the Game. It is interesting that all five groups represented on the Board have given up any possible claims they may have had to full independent control of the Laws of the Game, in virtue of their membership of the Board. As long as it continues to exist and they continue to support it, the Board itself is the body which controls these laws.

V. The F.I.F.A.[1]

British colonists and soldiers and sailors took football to all parts of the British Empire. Associations were formed in Ontario in 1882, in Manitoba in 1884, and a Canadian team visited England in 1888. The Natal Football Association was founded in 1882 and the Anglo-Australian Association in 1884 with its headquarters at Melbourne. The Indian Football Association was formed at Calcutta in 1883. The game was taken to the United States of America about 1875, but it did not make so much headway there as it did in Canada later. The American Football Association was founded in 1884. Football had also spread to Germany and Austria. It was played under mixed rules by German students, but in 1875 the Association laws were adopted by Lüneberg College, and this was the foundation of association football in Germany. In Belgium, Holland, Denmark, France and in other parts of Europe the association

[1] Data about the F.I.F.A. were obtained from Pickford(16).

game was also widely adopted by 1900.[1] The British teams who played Continental teams seem to have considered themselves unquestionably superior even when they did not win, for they sometimes attributed defeat to long and tiring Continental travel, but they are willing to admit great improvement in foreign football of late years—a characteristically insular attitude, though possibly the facts are true.

In 1904 the *Fédération Internationale de Football Association* was formed on the Continent at the suggestion of the French Union of Athletic Sports. This Union wrote to the Football Association in 1903, suggesting some such combination as the F.I.F.A. The reply was that the Council did not see the advantage of such a federation but was prepared to confer on all matters about which conference was desirable—a truly British reply and another piece of insular behaviour. As a result of doubts about the proper control of professionalism and about the adherence of the Continental players to the Laws of the Game, English delegates were sent to a conference at Berne in 1906. These delegates reported that a well-organized Federation was valuable and that The Football Association should play a constructive part in helping this body to develop Continental football to the best advantage. This co-operation was established and continued till the Great War brought it to an end. After the War attempts were made to set up a new organization excluding Germany and Austria, without success, and the F.I.F.A. continued with only a skeleton programme. In 1923, however, a conference was held in London, and as a result of this the British Associations joined the

[1] The dates of the first international matches between various countries disclose some of the steps in the spread of association football all over the world since 1900(12). Matches were played between Austria and Hungary n 1902, between Belgium and France in 1904, between the Argentine and Uruguay in 1905 and between Brazil and South Africa in 1906. In 1899 England played an unofficial match with Germany, and in 1908 many international matches on the Continent. Scotland played for the first time on the Continent in 1929, against Germany. In 1908 there was a match between Norway and Sweden at Göteborg; in 1910 between Denmark and England at Copenhagen; and in 1911 between Sweden and Finland at Helsingfors. Italy came into international football in 1910, by playing France at Milan; Spain came in 1920 and Portugal in 1921. In 1913 there was a match between China and the Philippines at Manila, and in 1917 Japan played China at Tokyo. In 1934 the Dutch East Indies played Japan at Manila. The U.S.A. played in the Olympic Games at Stockholm in 1916, and against Canada both at Montreal and at Brooklyn in 1925. Egypt played in the Olympic Football Tournament in 1920, and so did Greece and Jugoslavia. Rumania took part in the Tournament in 1922 and Bulgaria in 1924. In 1930 Cuba, Honduras, Guatemala, Costa Rica and Jamaica all took part in a big tournament at Havana. In 1937 there was a match between Central and Western Europe, and in 1938 the 75th anniversary of the foundation of the Football Association was celebrated by a match between England and the Continent at Highbury.

F.I.F.A. again on certain understandings about the rights of the International Board and about the avoidance by the F.I.F.A. of interference in the home affairs of its members. The F.I.F.A. was thereafter represented on the International Board by two delegates. This means that all the Associations united under the F.I.F.A. were represented together on an equal footing with England, Scotland, Ireland or Wales at this Board. The F.I.F.A. accepts the Laws made by The Football Association and altered and controlled since 1885 by the International Board. The *F.I.F.A. Handbook*(8) is published in English, French and Spanish, and in the English edition its Statutes and Regulations are printed in both English and German. English is the official language of the F.I.F.A., but speeches at its meetings are translated into French or German or English as required.

In 1927 there was a difficulty between the F.I.F.A. and the Committee of the Olympic Games, which wanted to control football at the Games, and the F.I.F.A. passed a resolution that it was itself the highest authority on all football matters and could not accept interference or guidance from outside. This caused some anxiety to the British Associations and to the International Board, because they did not wish to risk their independence by their co-operation with the F.I.F.A., although it was explained that the resolution was not aimed at them. However, the actual rift came in 1927, when the F.I.F.A. decided, in conference with the Committee of the Olympic Games in Paris, that payment for an amateur's loss of time should be recognized at the Games. The British Associations, determined to maintain a clear distinction between amateur and professional football, objected to this, regarding it as a form of sham amateurism, and withdrew from the F.I.F.A. At this point all the Associations again showed their very interesting capacity for compromise, because an arrangement was made by which the F.I.F.A. continued its membership of the International Board, though the British Associations are not members of the F.I.F.A. The F.I.F.A. accepts the International Board as lawmaker and has now established a World Cup Competition under its own control and having no connexion with the Olympic Games. The F.I.F.A. has a large membership of national associations from all parts of the world, but the British Empire Associations are affiliated to The Football Association. The Empire Associations pay affiliation fees only to The Football Association, but the other British Associations regard them as affiliated by these fees to Scotland, Ireland and Wales as well as to England, and do not ask for further fees. This again shows their capacity for compromise.

The position of Eire is very interesting, though unfortunate. When the formation of the Irish Free State took place in 1921, the Eire Association took the opportunity of joining the F.I.F.A. independently, and so lost its connexion with the International Board as part of Ireland. By doing this it became virtually a Continental Association and is represented on the International Board by the delegates of the F.I.F.A., and not as a British Association like that of Northern Ireland, which retained the title of the Irish Football Association, and continued to send two delegates to the Board. The Eire Association has now changed its name to the Football Association of Ireland, and it is very puzzling to the people on the Continent that this peculiar arrangement should exist. It is a hope of the future organization of international football that greater co-operation may be achieved than is now possible between the associations of Eire and of Ulster.

THE GENERAL FACTOR IN AESTHETIC JUDGEMENTS[1]

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I. *Previous investigations* (pp. 94–96).
II. *General plan of the present research* (pp. 96–98).
III. *Results and conclusions* (pp. 100–102).

I. Previous investigations

Several workers have recently been investigating the existence and nature of a 'general factor' in aesthetic appreciation. Dr Dewar has shown that both laymen and experts tend to put pictures of widely different merit in much the same order of liking; if their various rankings are correlated, and the resulting table factorized, we find that a large part of the variance is accounted for by a general factor (1).

Other investigators have shown reason to assume the existence of a general factor which would be operative not only within one test, but between tests of different kinds of aesthetic appreciation (even after the influence of intelligence had been eliminated). They found that "the capacity for literary appreciation correlates. . . with pictorial and musical appreciation" ((2), p. 283).

The general factor to be discussed here lies between these two factors, being more general than that discovered by Dr Dewar, but less extensive than that discovered by Williams, Winter & Woods. Admitting that there is a general factor appearing within any one test of visual appreciation, we ask if that factor would extend to all other tests of visual appreciation as well; or whether it would be specific to the one test in which it was observed.

Prof. Burt put the same question in the following form: "If we could brush aside all irrelevant associations, and take a completely detached view. . . would there be any solid grounds for preference left?" ((3), p. 289). Researches such as those mentioned above may seem to answer this question *a fortiori*, because if we admit the existence of an intersensory

[1] A paper read before the British Psychological Society, 1 April, 1939.

general factor, extending over literary and musical as well as pictorial material, the existence of a general factor for visual appreciation would seem almost inevitable. This argument is strengthened by the fact that Dr Dewar found that several different tests of visual aesthetic appreciation correlated together, even after the influence of intelligence had been eliminated.

And yet we feel unable to accept these results as finally settling the question raised by Prof. Burt. It would seem that the condition mentioned by him had not been fulfilled in these researches, viz. that all irrelevant associations should be brushed aside. The 'irrelevant associations', as they appear in the researches mentioned, are mainly of three kinds:

First, there is the influence of that complex of factors which we may call 'civilization'. Included here are teaching, tradition, general knowledge and all the thousand and one things that make up our cultural background. Dr Dewar's pictures, for instance, included "reproductions from classical masters, second-rate pictures by second-rate painters, every variety and type down to the crudest and most flashy birthday card" ((3), p. 290). Now it is easy to see that the influences mentioned above might exert an overwhelming force in favour of the 'socially accepted' pictures, such as the old masters, and against the 'birthday cards'.[1] Dr Dewar herself reports the influence of a factor of this nature (4).

Two minor factors working in the same direction we might call excellence of technique and familiarity. So far as technical excellence is concerned, the old masters in most cases are superior to the artists who draw the birthday-card type of picture, in the sense of being able to reproduce external objects more accurately. But preference on these grounds is not what we are looking for; we may prefer one photograph to another, not because it is superior aesthetically, but because the other one is technically imperfect—it may be out of focus, or underexposed. This is clearly an extraneous factor, whose influence should be minimized.

As regards familiarity, the attachment one forms so readily to things one knows well has often been remarked upon. When we encounter a picture we have seen before, or a picture painted in a familiar manner, the very fact that we have seen this picture, or a similar one, before disposes us more favourably towards it. The reaction against any new school of art is an eloquent witness to this contention.[2] At first, the un-

[1] This would be true primarily with regard to the 'experts' from whose rankings the correlations are taken on which Dr Dewar bases her general factor.

[2] There is an interesting discussion of this point in Koffka's *Principles of Gestalt Psychology*, p. 347.

familiar is disliked; as it becomes more familiar, liking increases. This has been proved experimentally by Moore (5). (It is not maintained of course that this effect is invariable and certain in all circumstances.)

If these criticisms have any validity, we should be able to derive certain principles from them as regards selection of pictures free from these 'irrelevant associations'. The pictures used in experiments of this kind should fulfil the following conditions: No tradition or teaching should point to one of them as superior to the others; so far as execution is concerned, they should be roughly of the same degree of excellence; and they should all be equally unknown to the subjects. Only if these conditions are fulfilled can we regard any test as genuinely testing the question at issue.

II. General plan of the present research

Within reason, the pictures selected for the present research comply with these three conditions. Eighteen sets of pictures were used altogether, each containing over fifteen pictures on the average. Nearly all of these were completely new to the subjects; even where they were not, no authority could point to one of them as superior to the others. The standard of technical excellence was uniform throughout each test. The sets used are described below:

Description of tests used in research on aesthetic appreciation

(1) *Portraits.* Thirty-two reproductions of comparatively unknown paintings by modern painters and old masters.

(2) *Emperors.* Fifteen photographs of statues of Roman emperors, taken from the British Museum.

(3) *Book-bindings.* Fifteen coloured reproductions of book-bindings, from the British Museum.

(4) *Claude Lorrain.* Twenty reproductions of pencil drawings by Claude Lorrain.

(5) *Blotters.* Twelve coloured photographs of 'Bathing Girls', used for advertising blotters.

(6) *Vases.* Sixteen coloured photographs of vases from the British Museum.

(7) *Masks.* Eight coloured reproductions of Malayan devil masks.

(8) *Japanese paintings.* Fifteen uncoloured Japanese paintings.

(9) *Ships.* Nine photographs of modern steamships.

(10) *Landscapes.* Twelve coloured landscape paintings by Japanese artists.

(11) *Sets.* Ordering the seventeen sets of pictures in order of liking.

(12) *Embroidery.* Twelve coloured reproductions of pieces of embroidery, from the Prince Albert and Victoria Museum.

(13) *Curves.* Twelve curves of mathematical functions, drawn in ink.

(14) *Statues.* Thirty-two reproductions of modern statues.

(15) *Flowers.* Fifteen coloured photographs of various flowers.
(16) *Pottery.* Twelve coloured reproductions of pottery from the East.
(17) *Plate.* Fifteen reproductions of pieces of silver plate.
(18) *Clocks.* Twelve reproductions of medieval clocks.

The eighteen subjects taking part in the experiment were drawn from various walks of life.[1] They included bank clerks, shorthand typists, painters, students, teachers, psychologists, and a Professor of Aesthetics. The number of subjects to be used was determined by the intercorrelations of their rankings; the object being to obtain an average ranking which for all practical purposes was equivalent to the 'true order', i.e. to the average order of the whole population. I have shown elsewhere on what reasoning the formulae used in this connexion are based, and that they can be applied to material of this kind (6). The average correlation between the average rankings and the 'true order' is 0·87, as is shown in Table I.

Table I

Tests	r_{ag}	r_{as}	$\bar{r}_{k\bar{k}'}$	$\bar{r}_{kk'}$	$r_{\bar{k}g}$	N
(1) Portraits	0·811	−0·005	0·40	0·16	0·88	32
(2) Emperors	0·810	0·232	0·51	0·26	0·93	15
(3) Book-bindings	0·661	−0·524	0·27	0·07	0·76	15
(4) Claude Lorrain	0·577	−0·277	0·40	0·16	0·88	20
(5) Blotters	0·571	0·480	0·40	0·16	0·88	12
(6) Vases	0·541	0·191	0·40	0·16	0·88	16
(7) Masks	0·478	−0·545	0·26	0·07	0·76	8
(8) Japanese paintings	0·461	0·074	0·39	0·15	0·87	15
(9) Ships	0·334	0·073	0·35	0·12	0·84	9
(10) Landscapes	0·327	0·163	0·49	0·24	0·92	12
(11) Sets	0·309	0·169	0·66	0·44	0·96	17
(12) Embroidery	0·244	0·152	0·33	0·11	0·83	12
(13) Curves	0·228	−0·503	0·52	0·27	0·94	12
(14) Statues	0·202	0·592	0·35	0·12	0·84	32
(15) Flowers	0·167	0·639	0·32	0·10	0·82	15
(16) Pottery	0·058	0·035	0·47	0·22	0·91	12
(17) Plate	−0·060	0·484	0·42	0·18	0·89	15
(18) Clocks	−0·287	0·397	0·30	0·09	0·78	12
Variance	0·206	0·137				
Average			0·40		0·87	15·6

r_{ag} = factor saturation, general factor.
r_{as} = factor saturation, bipolar factor.
$\bar{r}_{k\bar{k}'}$ = average correlation of individual rankings with average order.
$\bar{r}_{kk'}$ = average intercorrelations.
$r_{\bar{k}g}$ = correlation of average order with true order.

Having asked the subjects to rank the pictures in each of the eighteen sets in order of liking, one of two alternative courses was adopted to deal with these 324 rankings. The first was to correlate the rankings, factorize

[1] I should like to take this opportunity of expressing my gratitude to these subjects, all of whom devoted to the tests of this research a great deal of time and energy—four sessions of an hour each being the minimum time for testing.

the resulting table, and thus obtain weighted saturation coefficients. This was done when there was reason to suspect that bipolar, secondary factors played an important part in the choice, as for example in the 'Portraits' test, where the variance of the second factor is as high as 15%.[1]

In the majority of cases, however, a rough preliminary analysis showed no trace of a significant second factor, and then a simpler method was adopted.[2] The average of the rankings of each set was calculated, and each person's ranking correlated with this average, thus giving what might be called 'unweighted saturations'. Sixteen tests were found to contain no important secondary factors; only the 'Portraits' and the 'Statues' tests required to be fully analysed. The average of all the 324 saturations was almost 0·40; that is to say, on the average the subjects agreed to that extent with the average order. As each person's ranking contributes to the average order, however, the average saturation would be reduced to 0·34 (using a formula given by Garrett ((7), p. 460)).

The fact that these saturations are significantly positive[3] proves the existence of a general factor for each of the eighteen tests; it will be seen that so far our results bear out Dr Dewar's findings. But the factors are still not general in the sense we mentioned at the beginning; they may be specific to each of the tests, and not general from test to test. (As, for instance, a subject's score in an intelligence test may be specific to that test, and not allow any prediction as to his score in other tests.) To determine whether there is or is not a general factor of this kind, we may regard each person's (weighted and unweighted) saturations as his scores in the tests, and correlate the tests with one another. (Our procedure follows that of the intelligence tester, who correlates several tests and deduces factors from the pattern of their intercorrelations.)

The table of correlations can be factorized by means of one of the usual formulae; the factors running through the tests can be extracted, and an interpretation of these factors attempted on the basis of the experimental material. This method of dealing with the scores gives us saturations for the tests, showing how far they are saturated with the factors involved.

[1] The influence of bipolar or 'type' factors in aesthetic judgements, their nature and relation to temperamental qualities, will be dealt with in a later article.

[2] I am indebted to Prof. Burt for suggesting this method. Also, I should like to express my gratitude to him for reading this manuscript, and making many valuable suggestions.

[3] Eighty-one out of 324 saturations were 0·64 or over. By chance, we should expect only 1 in 100 to be as large as 0·64, according to Fisher's method.

III. RESULTS AND CONCLUSIONS

In Table I are shown the results of a factor analysis of the correlations between the eighteen tests used in this research. Fig. 1 gives a geometrical picture of the saturation pattern of the two factors responsible for all the correlations, within the limits of the probable error. It will be seen that we are dealing, first, with a general factor accounting for 20·6% of the variance, and secondly, with a bipolar factor, accounting

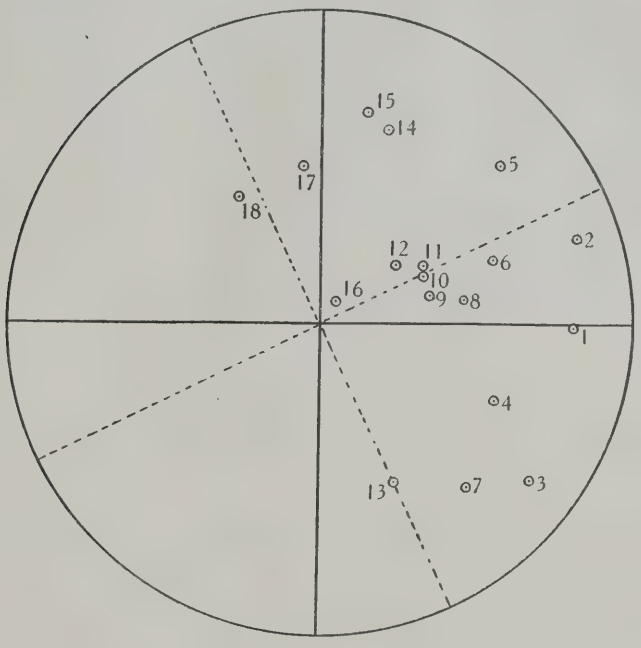

Fig. 1.

for 13·7%. Two tests have negative saturations for the 'general' factor, but these are extremely low and can hardly affect the generality of that factor. (The correlations between the two tests whose saturations are negative is only 0·089; this shows that we are not dealing with a genuine bipolar factor.)

In accordance with Thurstone's principles(8), we should rotate the axes in Fig. 1 till no negative values are left for the general factor, and the number of zero saturations is maximal. This rotation is shown graphically in Fig. 1, but as can be seen this rotation would have little effect on the main results. In certain situations, rotation has the effect

of eliminating the general factor altogether (9, 10), but this would not be the case here. The only effect would be a slight shift in the saturations for both the general and the bipolar factor.

Other results recorded in Table I are explained there. These values were calculated by formulae given by Burt (11); I have shown elsewhere that these formulae can legitimately be applied to data such as we are dealing with (6).

The nature of the general factor which we have found has already been indicated to some extent at the beginning of this article. It may be defined as the general, objective factor of aesthetic appreciation. We call it 'general' because it covers a large number of, probably all, pictorial tests, just as Spearman's 'g' covers a large number of, if not all, cognitive tests. We call it 'objective' because, as has been shown, it is largely independent of individual taste. The word 'objective' has been used in this sense by Burt (3), Wells (12), and others; it is not here taken to imply anything with regard to the independent existence of the object. This is a philosophical question which cannot be dealt with in a psychological article.

But a few words may not be out of place with regard to the common-sense interpretation of the general factor. As applied to persons, this factor is the core of reality behind what is generally called 'good taste' (whence it has been suggested that this factor should be called 'T'); as applied to pictures, it accounts for what we call 'beauty'; and finally, as applied to tests, it shows how good a measure of 'T' each test provides. The 'taste' of a person can be measured by 'correlating persons'; the goodness of a test by 'correlating tests'; the relative 'beauty' of the pictures by calculating the (weighted or unweighted) average of the scores given to it by the subjects.

If the nature of the general factor is thus fairly clear, the nature of the bipolar factor is less obvious. It is possible to define its meaning by examining those tests which are most highly saturated with it. Curves, masks, and book-bindings have high negative saturations; flowers, statues, plate, clocks, and blotters have high positive saturations. An inspection of the pictures in these sets suggests immediately a dichotomy well known to aestheticians—that between 'formal' and 'representative' art.

Curves, book-bindings, and devil masks are formal in the sense that they are concerned mostly with relations of line, colour, or volume; the flowers, statues, blotters tests, on the other hand, are not so much concerned with these relations, but rather with the representation of external objects, e.g. human bodies, flowers, etc. This interpretation is supported by the introspective reports of the subjects.

Thus we have obtained experimentally a confirmation of a theory often advanced by aestheticians; Kant's distinction between 'free' and 'dependent' beauty(13), Porena's distinction between 'il bello immediato' and 'il bello di rapporto'(14), and the theories associated with the names of R. Fry(15) and C. Bell(16), all seem to emphasize the same dichotomy between what we called 'formal' and 'representative' art.

Both the general and the bipolar factor are more comprehensive than has been indicated so far. As this article is concerned mainly with the general factor, a discussion of the formal-representative factor must be left for a subsequent article. As regards the general factor, a number of the subjects whose saturations for this factor were known took part in further experiments involving the ranking of thirty-one odoriferous substances, of ten colours, and of sixty-four polygonal figures. In each case a general factor appeared when the intercorrelations of these rankings were calculated. When the saturations for these observers were correlated with their saturations for the 'T' factor, the following results were obtained:

Odours and 'T' $= 0{\cdot}75 \pm 0{\cdot}17$
Colours and 'T' $= 0{\cdot}53 \pm 0{\cdot}22$
Polygons and 'T' $= 0{\cdot}68 \pm 0{\cdot}15$

(The number of subjects in these three experiments was eight, twelve and fourteen respectively. By Fisher's method, all but the second of these correlations are significant; the last is highly significant.)

It may be asked what possible meaning a factor can have that extends over such diverse objects as pictures, odours, colours and polygons. One might surmize that we are dealing here with a perceptual factor that derives directly from the nature of the nervous system; however, any positive answer to this question would involve too much speculation to be very helpful.

We have compared 'T', the general factor of aesthetic appreciation, with 'g', the general factor of cognitive ability. It may well be asked if these two factors are not at bottom one and the same thing, 'T' being merely the manifestation of 'g' when aesthetic material is used. In order to investigate this possibility, an intelligence test of the verbal type was given to the subjects,[1] and the correlation between 'T' and the scores in the intelligence test found. With a standard error of $\pm 0{\cdot}23$, the correlation was only 0·25, i.e. not significant statistically. It seems, therefore, that 'T' cannot be explained entirely in terms of general

[1] The test used has been described briefly by White(17).

cognitive ability, even though from the results of other workers it would appear that there is a slight positive correlation between intelligence and aesthetic appreciation.

Summarizing, we may state our main conclusions. First, evidence was found for a general, objective factor of visual aesthetic appreciation, which is independent of teaching, tradition, and other irrelevant associations. This factor is not identical with '*g*'. Secondly, this factor was found to extend over other modalities as well, correlating with a general factor derived from the ranking of odours. Thirdly, when this general factor was eliminated, a bipolar factor was found to emerge which seemed to divide the 'formal' from the 'representative' type of picture; a dichotomy lending support to theories long held by aestheticians.

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PUBLICATIONS RECENTLY RECEIVED

Selected Writings of Sir Charles Sherrington: A Testimonial Presented by the Neurologists Forming the Guarantors of the Journal 'Brain'. Compiled and Edited by D. DENNY-BROWN. London: Hamish Hamilton Medical Books. 1939. Pp. xiv+532. 25*s.* net.

Psychologists all over the world will welcome this splendidly produced tribute to Sir Charles Sherrington. The book consists of a selection of extracts and full reprints from Sherrington's classical papers. It is, as the publishers say, both "a testimonial and a source book". The papers are arranged in historical sequence and they show the beautiful and impressive continuity of Sherrington's work. To read them is to catch again the excitement and enthusiasm of original discovery, carried out with magnificent economy of method, with continued and unfailing insight, and expounded with brilliance and clarity.

Naturally those who are responsible for this book regard it as having a primary appeal to neurologists and to students of reflex physiology. But in truth the appeal to the psychologist is no less, and the lessons which the psychologist may learn in the way of unswerving fidelity to the demands of scientific method, the use of fruitful hypotheses and the fascinating pursuit of problems ever opening into new problems, are probably more needed in his case than in any others. Even in a most direct sense this is for the psychologist a book to study, and to study again and again, for the principles of the organization of behaviour, illustrated and discussed by Sherrington at the reflex and near-reflex levels, are illustrated repeatedly at the more complex levels of conduct, and Sherrington's work is absolutely fundamental for an understanding of the more highly developed forms of behaviour with which the psychologist is immediately concerned.

Collective Behaviour. By RICHARD T. LAPIERE. London: McGraw Hill Publishing Company. 1938. Pp. xiii+577. 24*s.* net.

"Social Psychology", says the author, "still retains its youthful vigour, but it has now passed its troubled adolescence and has arrived at a mature understanding of its phenomena." It is doubtful whether many readers who succeed in getting completely through this text-book will be willing to endorse this view. Partly this is because unfortunately the author adopts a rather dogmatic style of presentation and relegates to Appendixes, which may go unread, many of his more interesting remarks and most of his illustrations. Also he has a sort of general scheme of headings which gets repeated again and again, so that, for example, leadership, ideologies, membership, overt and covert aspects of interaction, and many other topics, are discussed scrappily in a number of contexts and nowhere fully. Partly, however, reluctance to admit maturity will arise because obviously the present methodology of social psychology, as illustrated in this book, is totally inadequate to support the certainty with which sweeping views are constantly stated. A great amount of very valuable raw material is, in fact, collected together in the way of notes to each chapter, but this alone hardly justifies the size and extent of the volume. Any reader will find much to interest him, yet taking it all through, this must be characterized as another disappointment in a field where assertion has vastly outrun verification.

Psychology in Everyday Living. By F. F. Powers, T. R. McConnel, W. C. Trow, B. V. Moore and C. E. Skinner. London: George G. Harrap and Co., Ltd. 1938. Pp. x+511. 8*s.* 6*d.* net.

This is to be regarded as a text-book for the college student, meant to help him not only to pass examinations but also to manage his own life. There are five main parts: the Nature of Psychology, Understanding Ourselves, Adjustment to College and Life, Learning and Study, and Applications of Psychology. To each chapter are appended a number of questions and a list of references for further reading. The book, on the whole, is well informed and its summary accounts of a mass of very varied knowledge and research are good and reliable. It does not always, however, succeed in combining very well its two different aims of imparting useful hints for life and of inculcating specialized information. The ordinary student is likely to find it a little long and tedious in places, and more than a little platitudinous. When laboratory and research problems are being dealt with, however, the discussions are good, and will be found useful in conjunction with any well-designed practical course.

General Psychology. By A. R. Gilliland, J. J. B. Morgan and S. N. Stephens. London: George Harrap and Co., Ltd. 1939. Pp. vii+461. 8*s.* 6*d.* net.

The authors have produced a good straightforward elementary text-book. There is nothing particularly striking about it, and on a good many points of necessity rather dogmatic statements are made about disputable conclusions. Yet the arrangement is good, the emphasis strongly practical, and the ground covered adequate. As a first-year book in a general teaching course this could be a very useful book.

The Science of Psychology. By Raymond Wheeler. New York: Thomas Y. Crowell Company. 1940. Pp. xviii+436.

Prof. Wheeler has entirely rewritten the book first published about ten years ago, and it may fairly be stated that his exposition has gained considerably in clarity, in usefulness to the intermediate and advanced student, and in comprehensiveness. Some of the more debatable material of the earlier edition has been left out, though fortunately a good deal still remains. The author states his belief that "the main trend in psychology for some years will be to take to nature for testing, refinement and specialisation, principles, constructs, and laws conceived, as they always have been, during 'Law-making epochs'". He thus considers that much attention will be given to the predictive value of psychological research, and some of his most interesting remarks deal specifically with the various problems of making predictions. He is strongly convinced that predictive success is possible only on the basis of a thorough and scientific study of the principles of integrated behaviour in the animal and human organism. While in a way this may be treated as a general text-book, and gives a great amount of detailed information, it does not lose a somewhat personal and definitely thought-provoking quality. A good teacher can hand the book to good students confident that they will gain much from its discriminating study.

Human Development and Learning. By Frank Seely Salisbury. London: McGraw Hill Publishing Company. 1939. Pp. xvii+513. 18*s.* net.

Human development and learning cover many things from pre-natal growth to aesthetic experience and the creative life, and 'the larger view' which appears to be another name for mankind's control of its destinies. It is a little difficult to know how

to treat this book. It is got up to look like a text-book and much of it reads like one. But it is rather more than that. It expounds and illustrates a consistent thesis that life is all the time developing according to certain fundamental principles of differentiation and increasing complexity, and of the creation of new patterns of response. It is not strikingly original either in matter or in style, but it could be read right through with interest and profit by any good student. Such a student might well be attracted by the sustained effort to run the same basic ideas through the discussion of many problems which are often kept out of touch one with another, and he would very likely be helped to attain a point of view for the study of psychological problems for himself. The book is well produced, but its price seems excessive.

Psychological Issues: Selected Papers of ROBERT S. WOODWORTH, with a Bibliography of his Writings. New York: Columbia University Press (London: Humphrey Milford). 1939. Pp. x+521. 25*s*. net.

This book is issued to commemorate the attainment by Prof. Woodworth of his 70th birthday. Psychologists everywhere will welcome this attractive reprint of articles which are scattered in many different periodicals and books. They cover a very wide range of topics and are collected under the general headings of Systematic Problems; Abnormal Psychology; Differential Psychology; Motor Phenomena and Educational Psychology. The contributions also vary widely in length and in thoroughness of analysis, but even the most fugitive papers contain interesting and stimulating ideas. One can open the book and read anywhere, certain of finding observations of great interest and of stimulating import. The criticisms of contemporary movements, and there are several, are invariably both courteous and pointed. Prof. Woodworth shows himself most impressively as a psychologist of wide interests, with a somewhat rare combination of general critical and constructive capacity, a love of exact knowledge and skill in experiment. This will come as no surprise to the many psychologists in every country who already know and appreciate his work, but the evidence is all the more impressive for being collected into a single volume. It is a book that every psychological library should contain, and that good students everywhere should be advised to study.

The Innumerable Instincts of Man. By CLAUDE A. CLAREMONT. London: Eyre and Spottiswoode, Ltd. 1940. Pp. 196. 6*s*. net.

Mr Claremont writes so pleasantly and persuasively that he almost convinces us of his ability to elucidate that perennial controversy as to the nature of instinct in man. He takes the instinct to be a spontaneous activity—not a response to stimulation—dictated by a quite definite and purposive, but unreasoning, choice of actions. Each instinct is defined by its characteristic goal and by certain characteristic fixed actions necessary to the attainment of that goal; but the intermediate actions are variable and adapted to the particular circumstances (thus distinguishing it from a reflex). In the more intelligent animal the fixed actions are fewer and more widely spaced; there is greater foresight and more possibility of varying the intermediate actions in the light of intelligence. Man possesses, not a few broad types of instinct, as postulated by McDougall, but a very large number of specific instincts—developmental, as shown in the building up of the power of perceiving, moving, thinking, etc., social and reproductive.

Mr Claremont adduces in support of his theory many recent observations of instinctive activity in animals, and of the development of children as studied in Montessori schools. But, plausible as his suggestions may be, one cannot but help an uneasy feeling that a different selection of data might have been less favourable to his highly speculative theory. Nevertheless, this very readable book adds a valuable contribution to the exploration of a difficult subject.

The book contains no index.

Child Psychology for Professional Workers. By FLORENCE M. TEAGARDEN. New York: Prentice-Hall. 1940. Pp. xxiii + 641. $ 3.25.

During the last few years there has been an enormous outrush of publications dealing with a vast variety of problems connected with child development. Also far more books than the world needs have appeared of a very general, popular and advisory kind dealing with the difficulties of parents and of teachers. It is therefore of real value to have an excellent, judicious and factual account of the most important knowledge that has been accumulated in this field of research; and Prof. Teagarden's book ought to receive a welcome, not only from the professional workers to whom it is dedicated, but also from the general psychologist and from the intelligent reader who has a wide interest in the social problems involved in the care and training of children. The volume deals with a large range of questions, always with an eye to the facts but always also with a view to the extraction of whatever general conclusions are possible. Naturally it is concerned largely with deviations from normal development, but these are dealt with in a sensible and helpful manner. There are some very good bibliographies and a very good index. Although the book has a general practical aim of bringing together into one volume the most important findings of a great amount of research, Dr Teagarden manages to make a large number of valuable observations of her own, and maintains also a consistently interesting style of writing. Perhaps the addition of some concentrated and critical appreciation of the most fruitful lines of present study and research would have added still more to a book which, as it stands, should be widely read.

The Education of Backward Children. By M. E. HILL. With an Introductory Chapter by H. BOYES WATSON. London: George G. Harrap and Co., Ltd. 1939. Pp. 174. 5*s*. net.

The Southend Group Test of Intelligence. The Southend Attainment Test in Mechanical Arithmetic. By M. E. HILL. London: George G. Harrap and Co., Ltd. 1939.

The Education Authority at Southend-on-Sea is to be congratulated on its decision to tackle the problem of educating the backward child, and upon the manner in which this was done. In his introductory chapter, the Chief Education Officer describes the survey made of the scholastic attainments of cross sections, made at the ages of 7+, 11+ and 14 years, of the total Elementary School population. This gave an idea of the number of seriously retarded children in the schools who must be dealt with. The schools were then reorganized, so that, in time and in so far as accommodation permitted, at least one small special class of not more than thirty children was provided in the Infants, Junior and Senior Department of each school. As far as possible, specially trained teachers were in charge of these classes; and they were advised and supervised by the Educational Psychologist, Miss M. E. Hill.

In the remainder of the book Miss Hill gives a clear and interesting description of (1) the tests used for diagnosing retardation in Arithmetic and Reading, and for measuring intelligence, and (2) the methods of teaching employed in the special classes for Infants, Juniors and Seniors. As far as possible, the children's individual activity was encouraged, both in acquiring the basic skills, and also in the more generalized 'projects'; and in the youngest children, every opportunity was given for phantasy expression. Full details are given of all these methods, together with information about books, material, etc. These should be of the greatest value to anyone employed in teaching backward children. Moreover, the book is of general interest to the psychologist in demonstrating the thought processes of children retarded either through innate dullness or through emotional maladjustment.

Post-Primary Education in the Primary Schools of Scotland, 1872–1936. By NEWMAN A. WADE. London: University of London Press. Pp. xvi + 275. 8*s*. 6*d*. net.